Issue: 15 | December 2024
www.fortishealthcare.com

Fortis

Clinical Connect

Fostering a culture of innovation and excellence

Combating Antimicrobial Resistance

Awareness, Action, and Accountability in AMR

IN THIS ISSUE

CONTENTS

Leadership Message

Dr Ashutosh Raghuvanshi
MD & CEO - Fortis Healthcare

India has one of the highest infectious disease burdens in the world, leading to high consumption of antibiotics and high incidence of AMR. In India alone, close to 3 lakh deaths were attributable to, and up to 10 lakh deaths associated with AMR. A 2023 study by the Indian Council of Medical Research (ICMR) revealed an alarming trend of increasing antibiotic resistance and decreasing effectiveness of commonly used antibiotics against pathogenic bacteria. It is thus the duty of each one of us to contribute in controlling this problem.

I am pleased to note that at Fortis we have implemented a robust Anti-Microbial Stewardship (AMS) Program to counter the problem of AMR. The program is developed and delivered in close coordination with all stakeholders and with support from our clinician colleagues. Some of the key components of AMS program are:

- Limiting the number of antibiotics available in our Pharmacy.
- Ensuring good quality of antibiotics.
- Promoting rational use of antibiotics, especially of Restricted Antibiotics'.
- Review of antibiotic prescriptions for justified use
- Preparation of antibiograms and calculation of Drug Resistance Index (DRI).

Further, AMR is included in agenda discussions at Hospital Medical Councils and at Infection prevention and Control Committees so that adequate oversight is maintained. Implementation of Electronic Medical Records (EMR) will further strengthen AMS by automated alerts and controls where required.

Consumption of antibiotics is widespread in India and studies have shown that more than 50% antibiotics are sold without accompanying medical prescription – this is an important contributor to rise in AMR. At Fortis, we regularly undertake campaigns for raising public awareness on this important issue – our recent campaign during the World Antibiotic Awareness Week (WAAW) being a good example of our commitment to the cause.

It is heartening to note that after a long gap new antibiotic have been launched – this gives hope to our clinicians but also reiterates the importance of judicious use lest they be rendered ineffective very soon. I am confident that sustained and coordinated efforts by private health sector, public sector, government bodies, Insurance providers, and Industry representatives like NATHEALTH, FICCI, CII, will very soon start yielding promising results in our fight against AMR.

Dr Bishnu Panigrahi
Group Head – Medical Strategy and Operations, Fortis Healthcare

Namaskar !

Over the past decade, we have consistently emphasized on the rational use of antimicrobials across our network of hospitals, recognizing the pressing global and national need to combat antimicrobial resistance (AMR).

Antimicrobial resistance is a growing crisis driven by the irrational use of antimicrobials. Despite stringent laws in India requiring prescriptions for antibiotic dispensation, over-the-counter availability remains a major challenge. This practice, along with incomplete adherence to prescribed courses of antimicrobials, exacerbates

resistance patterns and reduces the effectiveness of available treatments.

At Fortis Healthcare, we have adopted a comprehensive approach to address this issue through our Antimicrobial Stewardship Program. Key elements of this initiative include:

- Implementation of Standard Operating Procedures (SOPs) to guide antibiotic use across specialties, surgeries, and procedures.
- Annual preparation of antibiograms in every hospital to track resistance patterns and guide antibiotic selection.
- Promotion of the "Four Ds" of antibiotic stewardship i.e., Right Drug, Right Dose, Right Duration, and De-escalation.

This structured approach ensures that antimicrobials are prescribed and used responsibly, tailored to specific infections and sensitivity patterns. Additionally, we stress the importance of patient education. Antimicrobials should only be used under medical supervision, and completing the full prescribed course is essential to prevent resistance development.

Our commitment extends beyond Fortis Healthcare. As part of the IHH network, we aim to align with CDC norms on antimicrobial stewardship by 2025. This initiative underscores our responsibility to protect both individual health and global public health. Let us work together to combat antimicrobial resistance. By using antimicrobials judiciously, we can preserve their effectiveness for future generations and uphold the quality of care we provide to our communities.

Dr Murali Chakravarthy

Director - Clinical Affairs
Sr. Director - Anesthesia, Surgical ICU, and Pain Relief
Fortis Hospital – Bannerghatta Road, Bangalore
Chairman - Central Infection Prevention and Control Committee, Fortis Healthcare

Combating Antimicrobial Resistance - Whose Job Is It Anyway?

The "Clinical Connect" highlights the crucial yet under-discussed topic of combating antimicrobial resistance (AMR). Publications, discussions, case reports, and monograms by Fortis Healthcare testify to the importance given to this issue. Antimicrobial resistance is set to change how we approach infection control, and its champions will soon receive well-deserved recognition as the problem threatens to overwhelm.

AMR threatens healthcare globally. While misuse of antibiotics by doctors, patients, and healthcare workers is often highlighted, significant contributions from agriculture, aquaculture, and veterinary use are overlooked. Enforcing restrictions on over-the-counter antibiotics, auditing prescription practices, and ensuring full-course completion are beyond the realm of healthcare institutions. Governments, judiciary, and global organizations must collaborate to ensure laws are enacted and enforced. Combating AMR requires collective effort from healthcare institutions, professionals, academic bodies (e.g., ICMR), global organizations (e.g., WHO, CDC), and governments.

Healthcare Professionals: Preventing AMR primarily rests on healthcare professionals through educating patients on misuse, self-medication, and abuse. Stewardship programs to monitor, audit, and optimize antimicrobial use are critical (CDC, 2019).

Animal and Agricultural Use: Antibiotic use in veterinary, aquaculture, and agriculture significantly contributes to community resistance. The WHO's 2017 guidelines on responsible antibiotic use in food production provide best practices. Governments play a critical role in addressing misuse by these sectors (WHO, 2015).

Pharmaceutical Industry: The pharmaceutical industry faces challenges in developing new antibiotics. These drugs, termed "orphan molecules," often see restricted use post-development, deterring large-scale innovation. Governments must subsidize research, production, and marketing. Public-private partnerships and incentives can foster development (O'Neill, 2016).

Public Awareness: Raising public awareness through education requires careful planning and execution. NGOs can play an essential role in addressing antibiotic abuse and promoting adherence to medical advice on dosage and duration (CDC, 2017).

Global Collaboration: Addressing AMR is a global issue requiring collaboration among individuals, groups, and governments. The One Health approach connects human, animal, and environmental health, emphasizing the need for cohesive action (FAO, 2016). By uniting and adopting a multi-sectoral approach, significant progress can be made in mitigating AMR and safeguarding global health.

Dr Anita Arora
Director - Medical Operations
Group Head - Infection Prevention and Control,
Medical Strategy and Operations Group
Fortis Corporate Office

We are pleased to dedicate this issue of Clinical Connect to the critical topic of "Combating Antimicrobial Resistance." However, antimicrobial resistance (AMR) is no cause for celebration. It represents a serious public health crisis and an escalating threat to global health. Currently, resistance to antibacterials is the most urgent concern, though resistance to other types of antimicrobials is also on the rise.

The primary driver of antibiotic resistance is overuse. Antibiotics are often prescribed unnecessarily, even when they are not needed. While antibiotics are crucial for treating bacterial infections, they must be used judiciously to preserve their effectiveness. This is particularly vital, given the limited development of newer antimicrobials.

Clinicians, whether treating adults or pediatric patients, often face pressure from patients and their families to prescribe antibiotics at the first sign of fever or cough. This pressure is further intensified by the current healthcare climate. However, it is essential to educate

and reassure patients when antibiotics are not required, to preserve the efficacy of these vital medications.

Although factors outside healthcare settings contribute to AMR, healthcare professionals have a responsibility to safeguard both our patients and future generations by slowing the progression of this urgent issue. Greater emphasis should be placed on symptomatic treatment for stable patients, as well as infection prevention measures in both outpatient and hospital settings.

AMR is a serious problem, but one we must address with urgency. I will close with a quote from Goethe:

“Knowing is not enough; we must apply. Willing is not enough; we must do.”

Please send your comments, feedback and suggestions to clinical.connect@fortishealthcare.com

Scientific Publications

Multifocal Cryptococcus Neoformans Osteomyelitis in a Kidney Transplant Recipient

Source: https://indianjnephrol.org/multifocal-cryptococcus-neoformans-osteomyelitis-in-a-kidney-transplant-recipient/

Dr Sanjeev Gulati
Principal Director - Nephrology
Fortis Hospital, Vasant Kunj

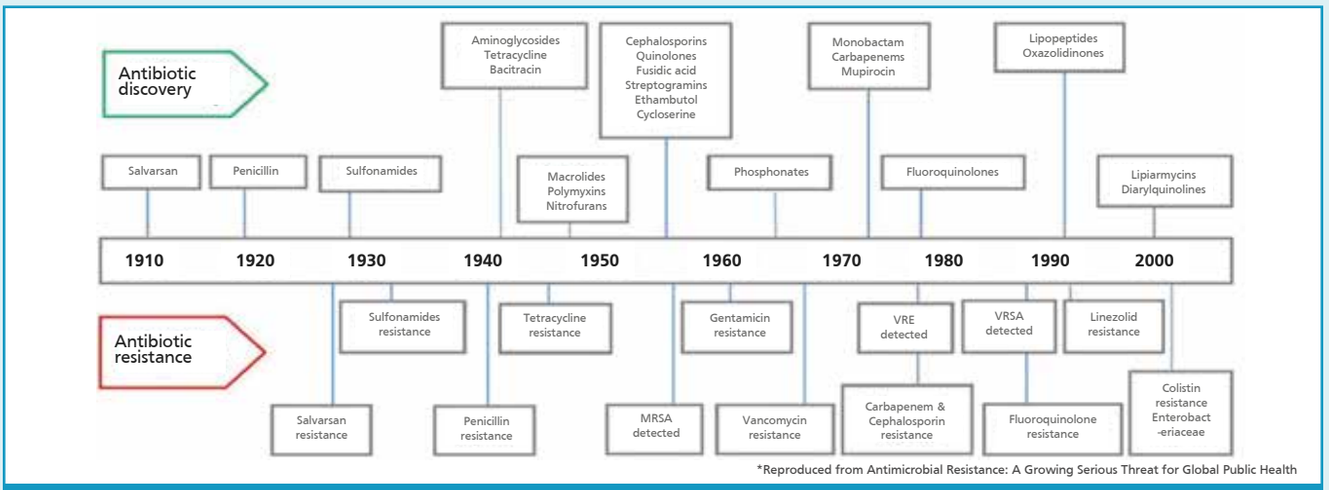
Dr Sanshristi Chauhan
Consultant - Nephrology
Fortis Hospital, Vasant Kunj

Abstract

Cryptococcal infections are notoriously difficult to diagnose and have been associated with high morbidity and mortality. Cryptococcus neoformans presenting as osteomyelitis is an unexpected clinical scenario in the transplant ward. A young male who underwent spousal kidney donor transplantation 16 months ago presented with painful and ulcerated soft tissue in upper and lower limbs which were diagnosed as cryptococcus osteomyelitis. He was managed with surgical debridement, liposomal amphotericin B, flucytosine and reduction in maintenance immunosuppression (IS). To our knowledge this is the first reported case of multifocal cryptococcus osteomyelitis in a kidney transplant recipient.

Keywords

Cryptococcus; Osteomyelitis; Transplantation



Timeline of discovery of major antibiotics and antibiotic resistance

Antimicrobial Stewardship Program at a Tertiary Care Hospital: A Road Less Travelled

Source: : Varma SC, Mandal AK, Sharma A, et al. Antimicrobial Stewardship Program at a Tertiary Care Hospital: A Road Less Travelled. JASPI. 2023;1(1):16-26 DOI: 10.62541/jasi003

Dr Shivani Juneja Bedi
Consultant - Clinical Pharmacology
Fortis Hospital, Mohali

Dr Amit Kumar Mandal
Director - Pulmonology, Sleep & Critical Care
Fortis Hospital, Mohali

Dr Anita Sharma
Director - Lab Medicine
Fortis Hospital, Mohali

Dr Parwinder Chawla
Senior Consultant - Internal Medicine
Fortis Hospital, Mohali

Ashwani Kumar
Lead AMS Pharmacist
Fortis Hospital, Mohali

Abstract

The manuscript provides a practical overview of implementing an antimicrobial stewardship program from a very nascent stage to a well-established program in the complex setting of a tertiary care hospital. It gives the readers a road map to initiate or refine their journey utilizing many principles of quality improvement, common sense, and negotiating complex human behavior. It also showcases a good use of the scientific principles of quality improvement and change management. Starting small with well-defined surgical prophylaxis paved the way for the complex world of empirical prescription of antimicrobials later in this journey. Various strategies like prescription audit and feedback, handshake stewardship, antimicrobial time-out, and greater mindfulness towards antimicrobial prescription have been well highlighted. Regular point prevalence surveys provided us with actionable data for multiple interventions. Moreover, it highlights the well-defined process and outcome metrics that measured the various aspects of antimicrobial prescription and were instrumental in assessing the success or challenges in implementing the program. Compliance with surgical prophylaxis improved from 34% to 71%, while compliance with de-escalation increased from 38% to 57%.

Keywords

Antimicrobial stewardship; antimicrobial time-out; prospective audit and feedback, SAFE approach, lead antimicrobial pharmacist, antibiotic chart.

Epidemiology and Preventability of Hospital-Onset Bacteremia and Fungemia in 2 Hospitals in India

Source: Gandra S, Singh SK, Chakravarthy M, Moni M, Dhekane P, Mohamed Z, Shameen F, Vasudevan AK, Senthil P, Saravanan T, George A, Sinclair D, Stwalley D, van Rheenen J, Westercamp M, Smith RM, Leekha S, Warren DK. Epidemiology and preventability of hospital-onset bacteremia and fungemia in 2 hospitals in India. Infect Control Hosp Epidemiol. 2024 Feb;45(2):157-166. doi: 10.1017/ice.2023.170. Epub 2023 Aug 18. PMID: 37593953; PMCID: PMC10877540.

Dr Murali Chakravarthy

Director - Clinical Affairs,
Sr. Director - Anesthesia, Surgical ICU, and Pain Relief,
Chairman - Central Infection Prevention and Control Committee,
Fortis Hospital – Bannerghatta Road, Bangalore

Abstract

Objective: Studies evaluating the incidence, source, and preventability of hospital-onset bacteremia and fungemia (HOB), defined as any positive blood culture obtained after 3 calendar days of hospital admission, are lacking in low - and middle-income countries (LMICs).

Design, setting, and participants: All consecutive blood cultures performed for 6 months during 2020–2021 in 2 hospitals in India were reviewed to assess HOB and National Healthcare Safety Network (NHSN) reportable central-line–associated bloodstream infection (CLABSI) events. Medical records of a convenience sample of 300 consecutive HOB events were retrospectively reviewed to determine source and preventability. Univariate and multivariable logistic regression analyses were performed to identify factors associated with HOB preventability.

Results

Among 6,733 blood cultures obtained from 3,558 hospitalized patients, there were 409 and 59 unique HOB and NHSN-reportable CLABSI events, respectively. CLABSIs accounted for 59 (14%) of 409 HOB events. There was a moderate but non-significant correlation (r = 0.51; P = .070) between HOB and CLABSI rates. Among 300 reviewed HOB cases, CLABSIs were identified as source in only 38 (13%). Although 157 (52%) of all 300 HOB cases were potentially preventable, CLABSIs accounted for only 22 (14%) of these 157 preventable HOB events. In multivariable analysis, neutropenia, and sepsis as an indication for blood culture were associated with decreased odds of HOB preventability, whereas hospital stay ≥7 days and presence of a urinary catheter were associated with increased likelihood of preventability.

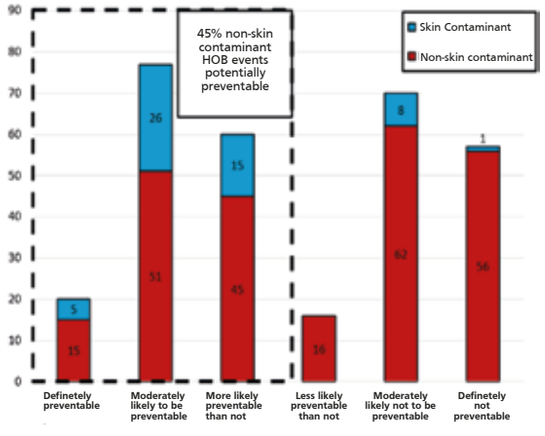
Conclusion

HOB may have utility as a healthcare-associated infection metric in LMIC settings because it captures preventable bloodstream infections beyond NHSN - reportable CLABSIs.

Hospital Characteristics	Hospital A	Hospital B
Type of hospital	Private, Tertiary-Care Teaching	Private, Tertiary Care
Total beds	1,250	300
Medical ICU beds	124	24
Surgical ICU beds	124	24
Oncology beds	36	18
Neurology ICU beds	14	12
Pediatric ICU beds	8	6
Neonatal ICU beds	22	12
Liver, kidney, and bone-marrow transplant services	Available	Available
Trauma services	Available	Available
Electronic medical records	Partial	Partial
Indigent patient services available	No	No
No. of full-time infection prevention nurses	5	2
Device-associated HAI and SSI surveillance conducted using CDC-NHSN criteria	Yes	Yes
Mandatory HAI reporting to national accreditation body	Yes (monthly)	Yes (monthly)
Clinical microbiologist,fulltime	Yes	Yes
Blood-culture system (automated)	BacT/ALERT	BacT/ALERT
Organism identification and antimicrobial susceptibility platform	VITEK2	VITEK2
National Accreditation Board for Testing and Calibration Laboratories, India Accreditation	Yes	Yes

*Reproduced from Epidemiology and preventability of hospital-onset bacteremia and fungemia in 2 hospital in India

Characteristics of the 2 Study Hospitals in India



Preventability rating of hospital-onset bacteremia and fungemia (HOB) cases in 2 hospitals in India during 2020-2021 (n=300)

A Comprehensive Analysis of Medication Errors with Antimicrobials in a Tertiary Care Hospital of Northern India

Source: Sharma, Riya & Juneja, Shivani & Saini, Deepak & Singh, Kulvir. (2024). A Comprehensive Analysis of Medication Errors on Antimicrobials in a Tertiary Care Hospital of Northern India. Journal of Antimicrobial Stewardship Practices and Infectious diseases. 2. 9-13. 10.62541/jaspi032.

Kulvir Singh
Assistant Supervisor - Pharmacology
Fortis Hospital, Mohali

Deepak Saini
Clinical Pharmacist
Fortis Hospital, Mohali

Dr Shivani Juneja Bedi
Consultant - Clinical Pharmacology
Fortis Hospital, Mohali

Abstract

Background: Medication errors, resulting from incomplete understanding, pose significant risks to patient safety. Antimicrobial medication error is a global concern further exacerbated by underreporting. This study aims to determine the prevalence of antimicrobial medication errors at a tertiary care medical facility.

Methodology

A retrospective study was conducted over six months. Antimicrobial medication errors were analysed and categorized as prescription, transcription, indenting, dispensing, and administration errors. A total of 208 antimicrobial medication errors were analyzed using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) risk index.

Results

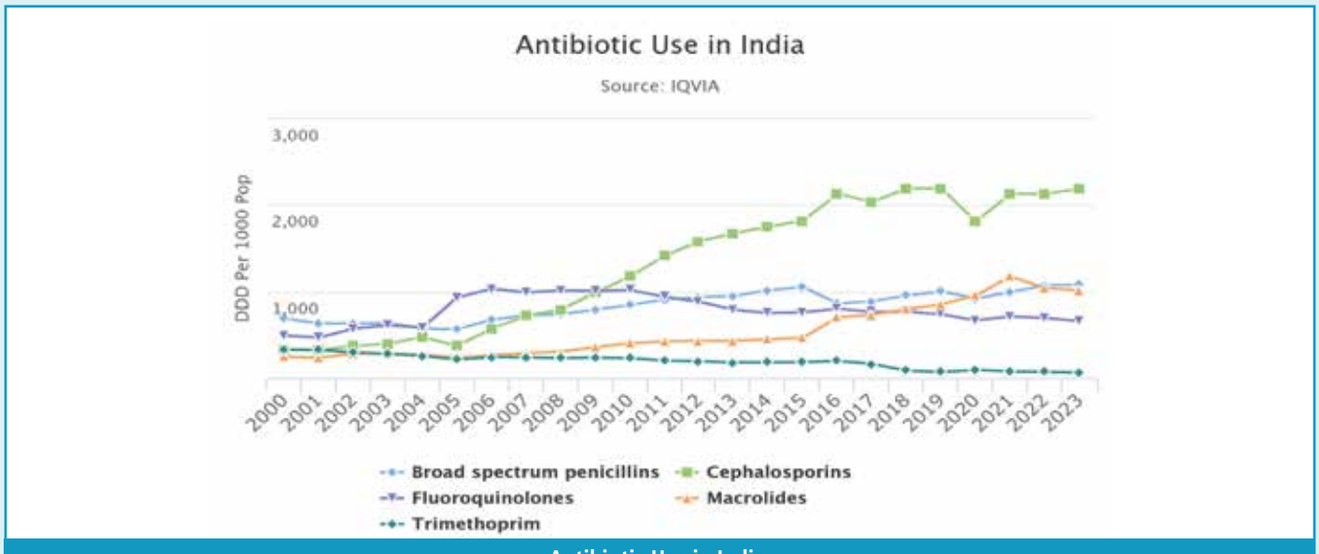
Among 6,439 medication charts assessed, 558 (9%) medication errors were identified, with antimicrobial errors accounting for 208 (37.2%). Prescription errors were the most prevalent (61%), followed by transcription errors (16%) and administration errors (11%). Dispensing, indenting, and documentation errors occurred at rates of 8%, 2%, and 2%, respectively. The primary causes of errors were incorrect doses (47.2%) and frequencies (30%). Approximately 55.3% of antimicrobial medication errors were classified as Category C according to the NCC MERP risk assessment.

Conclusion

Prescription errors represent the majority of antimicrobial medication errors, underscoring the need for enhanced vigilance among consultant physicians during prescription writing and drug schedule checks.

Keywords

Medication errors; antimicrobial errors; prescription errors; transcription errors.



Antibiotic Use in India

Role of Rapid Diagnostic Methods in Antibiotic Stewardship

Dr Mrinal Sircar

Director - Pulmonology and Critical Care
Fortis Hospital, Noida

Most of the initial antibiotic prescriptions are based on clinical assessment backed by basic laboratory and imaging data sans microbiological information. Frequently no microbiological tests are ordered, especially when patients are not very sick and treatment is expected to be short e.g. walking pneumonia or uncomplicated urinary tract infection. Antibiotics prescribed have spectrum deemed to cover most causative agents and are continue for days or till clinical resolution. Contrast this with prescription of say insulin, that would never happen without actually measuring blood sugar!

Conventional microbiological test come with some cost, results take several days and have low sensitivity viz. only average 30% blood cultures are positive. These factors limit their clinical utility. Hence, clinicians are often reluctant to even send these tests.

Many Rapid diagnostic tests (RDT) are now available that can be done either at point of care or in laboratory. They can identify presence of infection indirectly (e.g. Procalcitonin,[1] SeptiCyte RAPID [2]) or identify the organisms in minutes (Rapid antigen test for Covid-19) or hours (e.g. Biofire, MALDI-TOF) and resistance genes (e.g. Carba R) to guide antibiotic prescription. Early recognition of infection and starting appropriate antimicrobials has significant potential benefits.

We have shown that bronchoalveolar lavage (BAL) fluid Multiplex PCR significantly ($P<0.001$) decreases time to antibiotic modification compared to controls.[3] Similarly antibiotics could be changed earlier ($p<0.001$) based on BAL Biofire pneumonia panel than based solely on cultures.[4] In both our studies antibiotics could be deescalated in significantly more patients following rapid tests.[3, 4] In a German emergency department (ED) use of a high plex point-of-care PCR (SPOTFIRE ©Biofire) decreased length of stay in ED, antibiotic prescription rates and cost compared to laboratory-based PCR. [5]

The selection of RDT has to be based on "diagnostic stewardship" – a concept of right test, for right patient and at right time.[6] A recent meta-analyses showed a significant reduction in mortality associated with the use of RDT + antibiotic stewardship program (ASP) versus blood cultures (BC) alone (OR 0.72; 95% CI .59–.87) and with the use of RDT + ASP versus BC + ASP (OR, 0.78; 95% CI, .63–.96).[7] A reduced time to optimal therapy (TOT) was shown with RDT + ASP that can potentially reduce the exposure to antibiotics, possibly reducing antimicrobial resistance, improve safety, and costs.[7]

In 2017 Berlin declaration of the G20 Health Ministers affirmed rapid diagnostics as a key tool for manging antimicrobial resistance.[8] The WHO too has emphasized the need for rapid diagnostics.[9]
Future will bring even more innovative RDT including analysis of expired breath for volatile organic compounds to give microbiological diagnosis particularly for lung infections.[10]
The rapid diagnostic tests will strengthen antibiotic stewardship. This may change the way we prescribe antibiotics and treat our patients.

References

1. Liew YX et al. Eur J Clin Microbiol Infect Dis. 2011 Jul;30(7):853-5.
2. Von der Forst M et al. Infection. 2024 Nov 22. doi: 10.1007/s15010-024-02409-4.
3. Sircar M et al. J Crit Care 2016; 31:227-232
4. Sircar M et al. Crit Care 2020; 24 (Suppl 1):87, p446
5. Werbrouck A et al. The Impact of high-plex point-of-care diagnostic testing for acute respiratory tract infections in German emergency departments: An early cost-consequences analysis. https://doi.org/10.1016/j.jval.2024.06.020
6. Messacar M et al. J Clin Microbiol 2017; 55: 715-723
7. Peri AM et al. Clinical Infectious Diseases 2024;79(2):502–15
8. https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/G/G20Gesundheitsministertreffen/G20_Health_Ministers_Declaration_engl.pdf

How MDROs Have Entered our Community, Body and Homes

Dr Pankaj Kumar
Senior Director - Critical Care
Chairman - Infection Control
Fortis Hospital, Shalimar Bagh

It is a common belief that MDRO's (multi-drug resistance organisms) are found and generated in hospitals, but in recent times this may not be entirely correct. Resistance bacteria are present in community and present in our home environment. This trend is dangerous as millions of people are losing battle to antimicrobial resistance (AMR) and MDROs every year. AMR alone is killing more people than cancer and road traffic accidents combined besides economic loss. To combat AMR, it is important to find causes of generation of MDROs and how they enter human body and community environment. Therefore, it is important to realize the contribution by all the following four important factors: humans, animals, food and environment.

Prevention of MDROs and AMR in India is a challenge. India has been referred to as 'the AMR capital of the world'. While on one hand, emergence of newer multi-drug resistant (MDR) organisms pose newer diagnostic and therapeutic challenges, on the other hand India is still striving to combat old enemies such as tuberculosis, malaria and cholera pathogens, which are becoming more and more drug resistant. Factors such as poverty, illiteracy, overcrowding and malnutrition further compound the situation. Lack of awareness about infectious diseases in the general masses and inaccessibility to healthcare often preclude them from seeking medical advice.

Easy availability of **over- the- counter (OTC) drugs,** leads to self-prescription of antimicrobial agents or administered without any professional knowledge regarding the dose and duration of treatment.

Pharmaceutical industry has caused tremendous rise in the amount of chemical waste. With the lack of strict supervisory and legal actions, this waste reaches the **water bodies** and serves as a continuous source of AMR in the environment.

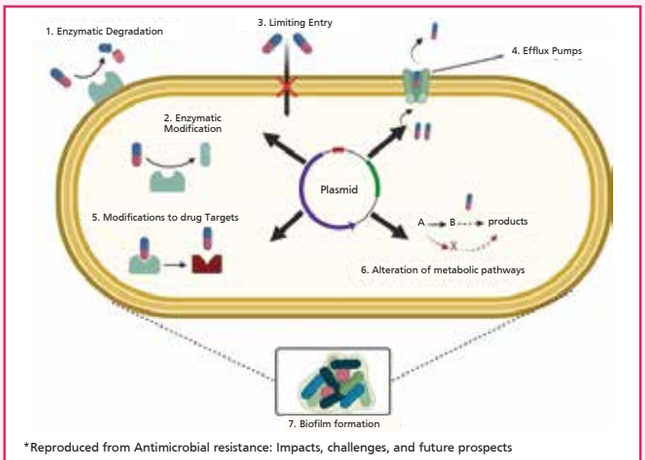
Another important challenge could be the use of antimicrobial agents as pesticides and insecticides in the **agriculture industry. Farmers** use antimicrobial agents to protect their hard-earned field and animals from pests and rodents. They are unaware about future consequences and impact on environment.

AMR in milk and food animals has been another big challenge. Gram - negative bacilli with extended - spectrum β-lactamases (ESBL) have been isolated from milk samples and poultry. Enterobacteriaceae isolated from fish and Salmonella species from broiler were isolated.

AMR in Environment: Antimicrobial - resistant bacteria have been reported from different water sources of India. The major sources are the pharmaceutical waste waters and hospital effluents that are released into the nearby water bodies without adequate treatment.

In large rivers of India, multiple inlets with varying concentration of drug-resistant bacteria have been found. ESBL producers among Gram-negative bacteria isolated and E. coli isolates found from north as well as south Indian rivers.

To combat AMR, there are many steps possible at community and Government level. Antibiotic stewardship plans for healthcare settings, promoting further research on the drivers of AMR, judicious use of antibiotics, strict vigilance of over the counter(OTC) antibiotics, control of hospital effluent plants, monitoring waste water discharges from pharmaceutical companies, regulation of use of antimicrobial in food and milk animals, improving agricultural practices and educating masses at community level about AMR.



*Reproduced from Antimicrobial resistance: Impacts, challenges, and future prospects

Bacteria may also create biofilms, surface-bound communities with varying nutrition levels and limited antibiotic penetration. These resistant mechanisms are summarized in the figure.

Preventing Antimicrobial Resistance (AMR) Together - Be a "PART"of the Cause

Dr Neha Rastogi Panda

Consultant - Infectious Diseases
Fortis Memorial Research Institute,
Gurugram

The rise and spread of AMR especially in post-COVID scenario has become "GLOCAL" emergency and one of the mammoth silent pandemic. This is indeed a huge challenge for health care stakeholders all across the globe, compounded by the "discovery void" in the field of development of new antimicrobials and thus have serious implications in terms of morbidity, mortality and overall health care cost.

Though AMR is an evolutionary phenomenon, but has accelerated especially in our settings owing to variable attributes- easy access and over -prescription, inadequate choice and dosage, usage in agriculture and livestocks causing interspecies spread and limited active AMR surveillance further adds fuel to the fire. The quantum of antibiotic resistance development is under-stated in our settings.

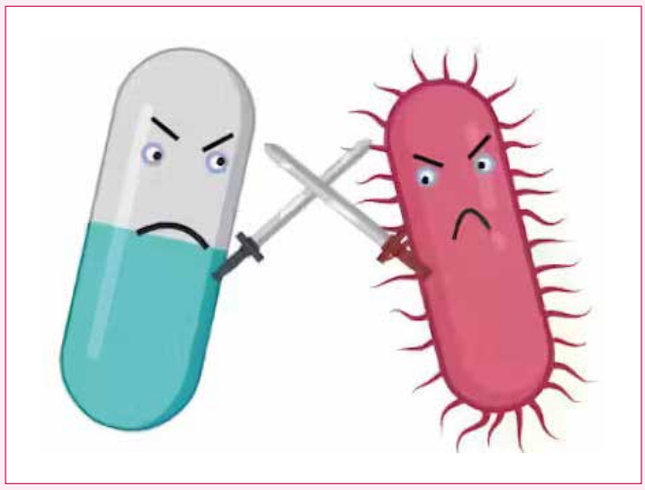
This contributes to ever-rising multidrug resistant "MDR" and extensively drug resistant "XDR" SUPERBUGS burden, resistance and relapses in treatment, increased hospital stays and eventually poor clinical outcomes. In the current deluge of ever-evolving contagious diseases, the most challenging aspect of clinical practice is to combat the infections due to these drug-resistant organism and to halt vicious cycle of its spread.

In this Viewpoint, we all require concerted efforts with **3D** – right **D**ecision, early **D**iagnosis and **D**e-escalation (step down) strategy among all sectors while prescribing antimicrobials. This pandemic has also created a renewed awareness and need for capacity building and coordination at the national and international organizations and to ensure effective global action against this complex threat since "No action taken today, no cure tomorrow". The implementation of Antimicrobial Stewardship Programs (ASP) across all health-care settings as an effort to promote appropriate antibiotic use and combat antibiotic resistance in the community has become a public health and national security priority in recent years. Hospital based programs with emerging AMR leaders, Infectious disease physicians , Microbiologists and pharmacists as drivers of AMSP dedicated to improving antibiotic use, have been found helpful in improving the quality of patient care and safety through increased infection cure rates, reducing treatment failures, and increasing the frequency of correct prescription for therapy and prophylaxis.

Being **AWARE** is essential pre-requisite in current settings to combat AMR with **Access** - antibiotics to treat the most common infections, **WAtch** -antibiotics availablity and **Reserve**-antibiotics preserved and used only as a last resort approach. Another essential determinant and drivers of AMR in community settings is intersectoral usage and spread. Strong evidence indicates that release of antimicrobial compounds to the environment, with direct contact between natural bacterial communities and discharged resistant bacteria, are driving bacterial evolution and the emergence of more resistant strains.

Thus, holistic approach to AMR requires **"ONE - HEALTH"** approach - multisectoral, multi-disciplinary approach and ensure communication, collaboration, and coordination among all relevant ministries, agencies, stakeholders, sectors, and disciplines, for optimal action.

AMR is an enormous pandemic requiring multi-pronged 3 **"R"** approach- **R**ising awareness, **R**ight efforts and **R**egulatory strategy and above all driving force of "Aao Milke Rokein" in all healthcare and community stakeholders.



How Nurses Help Combat Antimicrobial Resistance

Girja Sharma
Chief Nursing Officer
Fortis Hospital, Shalimar Bagh

Antimicrobial resistance (AMR) is a significant and growing challenge in global healthcare, with hospitals across India experiencing its impact. AMR occurs when microbes—such as bacteria, viruses, fungi, and parasites—become resistant to antimicrobial drugs, including antibiotics, antivirals, antifungals, and antiparasitic. This resistance makes infections that were once manageable much harder to treat. Nurses, who are on the frontline of patient care, are in a unique position to help combat AMR through diligent practices and patient education.

Nurses and Antimicrobial Stewardship

Nurses play a critical role in **antimicrobial stewardship programs (ASP),** which focus on ensuring that antimicrobials are used appropriately and only when necessary. Here are some of the key ways nurses contribute to these programs:

- **Ensure Correct Antimicrobial Use:** Nurses ensure patients receive the appropriate antimicrobial agent at the correct dose and time. This is essential in preventing ineffective treatment and in reducing opportunities for resistance to develop.
- **Monitor Patient Responses:** Nurses closely observe how patients respond to antimicrobial treatments. If a patient shows no improvement or experiences side effects, nurses promptly notify the medical team to adjust the treatment plan, reducing the risk of further resistance.
- **Collaborate with the Medical Team:** Nurses work alongside doctors and clinical pharmacists to review antimicrobial prescriptions. For example, if a patient is receiving multiple antimicrobials, nurses can assist in streamlining therapy by communicating about recent lab results, including culture and sensitivit which can help guide the treatment approach.
- **Support Culture and Sensitivity Testing:** Before initiating antimicrobial treatment, nurses ensure samples are collected for lab testing. This helps in selecting the most effective agent from the beginning and reduces the need for broad-spectrum antimicrobials, which can drive resistance.
- **Prevent Overuse of Antimicrobials:** Nurses play a vital role in preventing the overuse of antimicrobials by advocating for timely discontinuation when they are no longer needed, reducing the risk of prolonged or unnecessary use.

Educating Patients on Proper Antimicrobial Use

Patient education is another essential aspect of a nurse's role. Many patients are unaware that antimicrobials, such as antibiotics, are ineffective against viral infections like the common cold or flu. By educating patients about the appropriate use of antimicrobials, nurses help decrease the incidence of inappropriate requests and misuse. Some ways nurses educate patients include:

- **Complete the Full Course:** Patients often stop taking antimicrobials when they start feeling better, which can contribute to resistance. Nurses explain why completing the full prescribed course is essential in preventing the development of resistant microbes.
- **Avoid Self-Medication:** Patients may use leftover antimicrobials or purchase them without a prescription. Nurses educate patients on the dangers of self-medicating, emphasizing how it contributes to resistance and can worsen infections.

Infection Control: Reducing the Need for Antimicrobials

Preventing the spread of infections is one of the most effective strategies to reduce the use of antimicrobials. Nurses play an integral role in infection control practices, including:

- **Hand Hygiene:** Proper hand hygiene is one of the most effective ways to prevent the spread of infections within healthcare settings. Nurses set an example and ensure that all healthcare personnel and visitors follow proper handwashing protocols.
- **Correct Use of PPE:** Nurses are vigilant about the correct use of personal protective equipment (PPE) to prevent cross-contamination among patients, thus reducing the likelihood of new infections.
- **Adherence to Wound Care Protocols:** By following strict wound care guidelines, nurses help prevent surgical site infections and other wound-related infections, ultimately decreasing the need for antimicrobial treatments.
- Timely **Specimen Collection:** Nurses are responsible

for collecting specimens promptly for microbiological testing, which allows for quick identification of infections and targeted treatments that avoid unnecessary broad - spectrum antimicrobial use.

Continuous Learning: Staying Updated on Best Practices

Since AMR is a constantly evolving issue, continuous professional development is crucial for nurses to stay informed on the latest guidelines. Through training, workshops, and online courses, nurses can keep updated on infection prevention, proper antimicrobial usage, and resistance trends. Hospitals play a key role by offering regular educational opportunities focused on infection control, antimicrobial resistance, and new therapeutic guidelines.

What You Can Do

Whether you're a nurse, doctor, or clinical pharmacist, small, daily actions can collectively make a big impact against AMR:

- Rigorously follow hand hygiene and infection control protocols.
- Only prescribe or administer antimicrobials when absolutely necessary.
- Educate patients on the importance of completing their prescribed course of treatment.
- Stay informed on the latest evidence-based practices through ongoing education.

Conclusion

Nurses are critical in the fight against antimicrobial resistance. By collaborating with other healthcare professionals, educating patients, following infection control practices, and continually learning, nurses help protect the effectiveness of antimicrobials for future generations. These collective, conscientious efforts are essential to reducing resistance and improving patient outcomes. Together, healthcare teams can help ensure that antimicrobials remain effective tools in the fight against infections for years to come.

Clinical Pharmacists: Understanding their Pivotal Role in Enhancing Patient Care and Combating Antimicrobial Resistance

Dr Shivani Juneja Bedi
Consultant - Clinical Pharmacology
Fortis Hospital, Mohali

Gayatri Sapkale
Team Leader - Clinical Pharmacology
MSOG - Fortis Corporate Office

Antimicrobial resistance (AMR) poses a growing threat to healthcare systems worldwide, and its impact is undeniable. Recognizing this challenge, CDC guidelines and AMS committee frameworks emphasize the crucial role of Clinical Pharmacists in Antimicrobial Stewardship Programs (ASPs). Acting as a bridge among microbiologists, infectious disease physicians, nurses, consultants, patients, and the medical administration team; Clinical Pharmacists have emerged as pivotal contributors to ASPs.

From ensuring timely administration of optimal antibiotics to refining prescriptions through culture reviews and allergy testing, clinical pharmacist-led interventions have proven transformative. These efforts not only cut costs but also minimize unnecessary antimicrobial use, a critical step in combating AMR.

Unit Antimicrobial Stewardship Working Group (ASP WGs) lead the ASP, focusing on minimizing overuse of antibiotics, promoting timely IV-to-oral shifts, and optimizing antimicrobial therapies. With Clinical Pharmacist contributing significantly to these efforts by driving dose optimization and improving documentation, ASP is strengthened across the organization.

There are studies in literature demonstrating the success of pharmacist-led AMS interventions across diverse hospital environments, including general medicine wards, emergency departments, radiology units, and smaller hospitals lacking infectious disease specialists. In all these settings, Clinical Pharmacists led interventions reduced antibiotic use, therapy durations, and associated costs. The acceptance of pharmacist

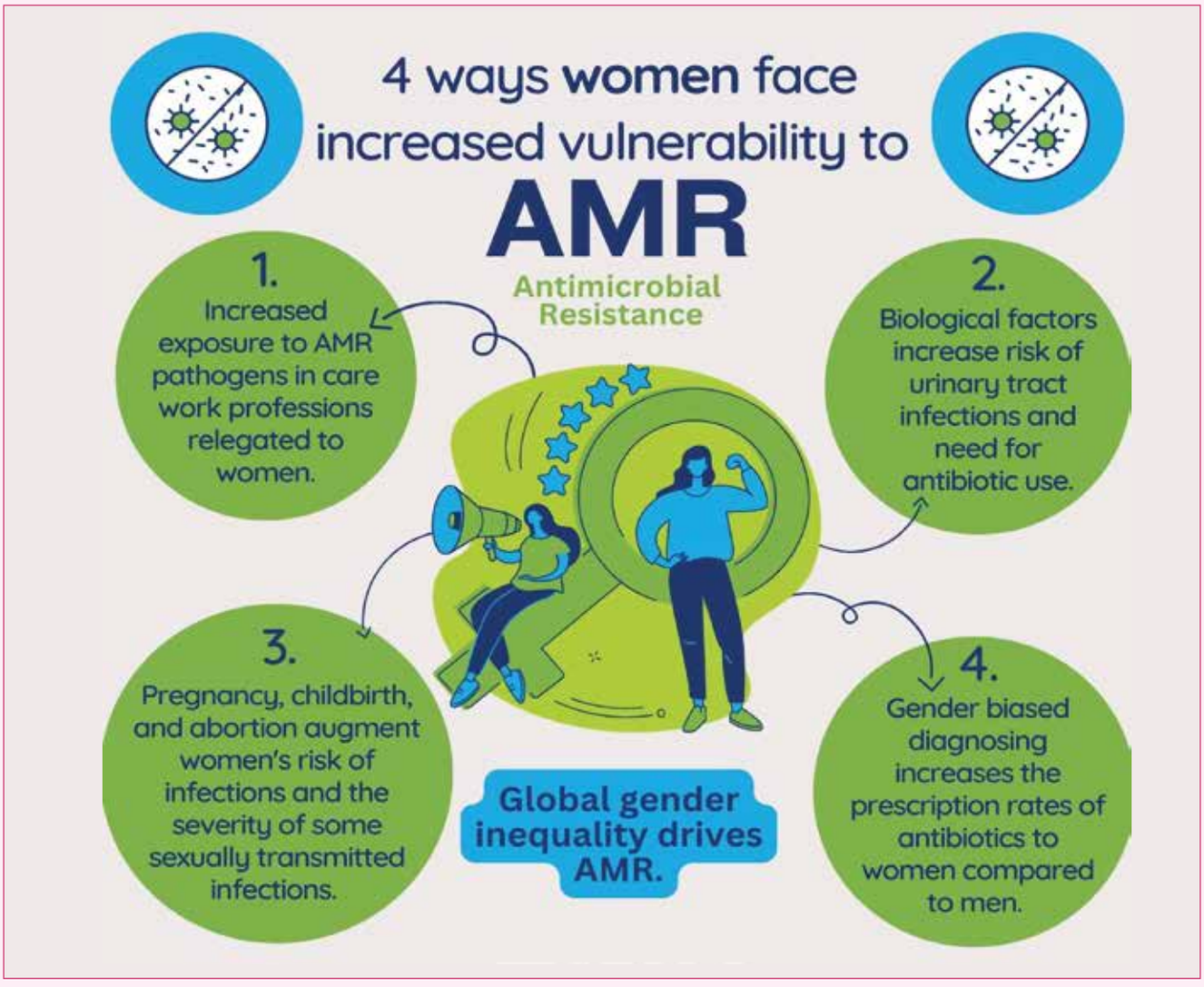
recommendations by physicians has been remarkably high, fostering a collaborative environment for stewardship. These partnerships strengthen the implementation of evidence-based practices, further optimizing antimicrobial use.

The ASP initiative empowers Clinical Pharmacists in enhancing their role through training and encouraging multidisciplinary collaboration. This further helps to improve antimicrobial prescribing, boost job satisfaction, and create a culture of accountability in combating AMR. By training AMS champions in various specialties and fostering teamwork, FHL is setting a standard for effective stewardship in the fight against AMR.

At FHL, Antimicrobial Sewardship Working Group (AMS WGs) in mostly units Clinical Pharmacist lead the charge in the ASP to ensure that antimicrobials are prescribed judiciously. In the absence of Clinical Pharmacists, Infection Control Nurses (ICNs), nurses, and pharmacy staff step up to uphold AMS principles, working tirelessly to maintain the program's integrity.

Integrating strong AMS practices across all departments is essential to improving patient care, reducing healthcare costs, and preventing unnecessary antibiotic overuse. Collaborative teamwork is at the heart of all successes. Partnering with multidisciplinary teams, including pharmacy, infection prevention, microbiologists, and consultants, is essential for evidence-based prescribing and overcoming barriers to optimal antimicrobial use. Together, these efforts highlight the shared responsibility in combating antimicrobial resistance and improving patient outcomes.

To conclude, Clinical pharmacists are integral members of healthcare teams, ensuring that patients receive the best possible outcomes from their medications. They combine deep knowledge of pharmacology, patient care, and clinical practice to optimize medication use, prevent errors, and manage complex drug therapies. Through collaboration with other healthcare providers, they help improve patient safety, reduce hospitalizations, and in combating AMR and promoting the optimal use of antibiotics in clinical practice.



A Retrospective Study to See the Comparison of Biofire Pneumonia Panel Results with the Conventional Culture

Dr Ravneet Kaur
Head Microbiology and Lab Service
Agilus Diagnostics,
Fortis Hospital, Noida

Surabhi Wasan
Junior Scientific Officer
Agilus Diagnostics,
Fortis Hospital, Noida

Shefali Singh
Section Technical Supervisor
Agilus Diagnostics,
Fortis Hospital, Noida

Savita Mishra
Section Technical Coordinator
Agilus Diagnostics,
Fortis Hospital, Noida

Manoj Kumar
Section Technical Coordinator
Agilus Diagnostics,
Fortis Hospital, Noida

Antimicrobial resistance (AMR) is a serious global concern, it is estimated that by the year 2050, Asia will have 4.5 million deaths due to AMR. AMR is rampant in India with 12-59 % of E coli showing ESBL production and up to 30 % being carbapenemase producers (ICMR treatment guidelines for antimicrobial use in common syndromes 2019).

To combat the AMR, the use of antibiotics needs to be optimized in all cases and for this rapid method of detection of type of infection and the type of resistance are required.

Biofire/film array is a nested PCR which combines automated sample preparation, nucleic acid extraction and PCR-based detection of multiple separate targets from a single unprocessed sample in one hour. It combines nesting and multiplexing of the PCR (referred to here as nested multiplex or "nmPCR") .

Due to the enclosed pouch, there is low risk of laboratory contamination.

Biofire pneumonia panel is a comprehensive panel which detects various pathogens (15 bacteria with resistance genes: CTX-M, IMP, KPC, oxa 48, mec A/C and MREJ, NDM, VIM), atypical bacteria and viruses , gives semi quantitative analysis giving results in bin/ml.

A retrospective study was carried out in the department of microbiology, Agilus diagnostics, Fortis Hospital, Noida of 18 samples where both biofire and conventional culture had been put up.

The choice of samples was BAL and mini BAL which is as per manufacturers recommendation.

The cultures were put up as per the standard lab protocol and reported in semi quantitative numbers.

The comparison of colony count was not done in both the methods since the units in both methods are different and not comparable. Following table shows the comparative results of both the methods.

S.NO.	Biofire Result	Conventional Culture Results	Remarks
1.	Serratia marsecescens	Candida Tropicalis	Not concordant - Organism isolated in culture is not in biofire menu
2.	Escherichia coli. (E coli), Klebsiella pneumoniae (kleb pn)	Negative	Not concordant
3.	Enterobacter cloacae	E coli	Partially concordant (different organism, although of same family)
4.	Haemophilus Influenzae (Hflu) Pseudomonas Aeruginosa (PAE)	PAE	Partially concordant, Biofire can pick multiple organisms
5.	Negative	Candida albicans	Not concordant - Organism isolated in culture is not in biofire menu
6.	Negative	Negative	Concordant
7.	Negative	Culture not sent	NA
8.	Hflu, PAE, MRSA	Negative	Not concordant
9.	Negative	Negative	Concordant
10.	Hflu	Negative	Not Concordant
11.	Kleb pn, E coli, PAE	Kleb pn	Partial concordant - Biofire can pick multiple organisms
12.	E COLI, PAE, kleb PN	PAE, kleb PN	Partial concordant -Biofire can pick multiple organisms
13.	Acinetobacter baumanii (A baumanii),	A baumanii	Concordant
14.	Kleb pn	Kleb pn, candida albicans	Partially concordant (not in biofire menu)
15.	Streptococcus pneumoniae, E coli, enterobacter, PAE, Streptococcus agalactiae	Streptococcus pneumoniae	Partial concordant - Biofire can pick multiple organisms
16.	Negative	Negative	Concordant
17.	Negative	Negative	Concordant
18.	Negative	Negative	Concordant

Summary and conclusion

35% of the results were concordant.

35% were partially concordant and 29% were non concordant.

The type of resistance in these organisms allowed for the optimum antibiotic therapy in these cases.

For a satisfactory diagnosis and an optimum therapy, it is recommended that both culture as well as a rapid method for the antibiotic resistance are prescribed.

Prosthetic Valve Endocarditis Caused by Brucella Melitensis- Case Report

Dr Sukanya Verma
Microbiologist
Agilus Diagnostics Limited, Mumbai

Abstract

Brucellosis is zoonotic infection caused by Gram negative bacilli – Brucella species. Brucellosis is a common cause of PUO in Brucella endemic areas that include South east Asian region and Mediterranean regions. Infection is transmitted to humans via consumption of unpasteurized dairy products, or coming in close contact with secretions of infected animals. The clinical symptoms are nonspecific and mimic many other infectious and noninfectious conditions complicating the diagnosis. It can present as simple relapsing fever. If left undiagnosed can progress to cause complications like endocarditis, sacroiliitis, osteomyelitis, spondylodiscitis, septic arthritis, and epidural abscess, hepatic abscesses and granulomas Brucella endocarditis is a rare occurrence and can involve native as well as the prosthetic valve.

Laboratory diagnosis can be established using culture and serology. Culture is the gold standard. Serological test helps to detect IgG and IgM antibodies. These are rapid and help in early identification of the infections. Timely diagnosis is essential in preventingdevelopment of complications and also prevents development of antimicrobial resistance by use of bug specific antimicrobials.

WHO guidelines recommend use of triple drug combination of Rifampicin, Doxycycline and Amikacin for 6 to 12 months depending on the course of illness. Uncomplicated cases require shorter duration of treatment as compared to complicated.

High clinical suspicion and availability of correct diagnostic modality is key to early diagnosis of these infections.

Here we report a case of prosthetic valve endocarditis caused by Brucella melitensis which was diagnosed using serology and culture and treated using the triple drug regime. The patient responded well to therapy. Specific diagnosis is essential to prevent use of empiric and injudicious use of antibiotics contributing to antimicrobial resistance.

Keywords

Brucellosis, Brucella melitensis, Endocarditis, Blood culture, Serology, Triple regime, antimicrobial resistance.

Is it Time to Say "RIP Azithromycin?" – A 4-year Study from a Tertiary Care Laboratory in Eastern India

Dr Kokila Banerjee
Head - Microbiology
Agilus Diagnostics
Dr Tribedi & Roy
Diagnostic Laboratory

Dr Subhendu Roy
Lab Director
Agilus Diagnostics
Dr Tribedi & Roy
Diagnostic Laboratory

Abstract

Community Acquired Pneumonia (CAP) is caused by several bacterial and viral pathogens. Streptococcus pneumoniae is the most common pathogenic cause of pneumonia in children and elderly population in the community. Mortality is high if not adequately treated early. Macrolides, especially azithromycin has been the mainstay of treatment over the last four decades due to several advantages that it offers. However, recent upsurge in resistance has jeopardized the use of this agent as a monotherapy. However, it continues to feature in the latest ICMR 2022 guidelines as a part of combination first line empiric therapy for CAP in

patients with co-morbidities as well as ICU and non-ICU inpatients. We report extremely high rates of macrolide resistance amongst Streptococcus pneumoniae strains isolated from sputum samples received in the laboratory from November 2021 to November 2024, ringing the death bell for this class of antibiotics, in the treatment of CAP.

Keywords

Streptococcus pneumoniae, CAP, community acquired pneumonia, Macrolide, Erythromycin, Azithromycin, Resistance, Nafithromycin.

Introduction

Community acquired pneumonia (CAP) accounts for a high percentage (14-30%) of mortality in children[(1)] as well as the elderly population[(2)] in India. Causes of CAP are varied including bacteria, viruses and even mycobacteria. S. pneumoniae (3-51%) followed by H. influenza (5-21%), happen to be the commonest agents not only in India but across the globe. Mycoplasma pneumoniae, respiratory viruses alongside Legionella species and S. aureus follow next. Klebsiella pneumoniae and Pseudomonas aeruginosa are isolated only in certain groups of severely ill, elderly patients. Mycobacterium tuberculosis should be suspected in patients with protracted illness.[(3)]

Azithromycin, a macrolide, is a part of ICMR guidelines for empiric treatment of adult CAP. The rate of resistance to macrolides is on the rise and as per the ICMR 2022 guidelines, it has been recommended to use Azithromycin along with Amoxicillin-clavulanic acid for patients of CABP with comorbidities and as an alternate choice to amoxicillin-clavulanic acid, in patients without comorbidities. The rate of resistance as stated in the 2022 document is 25-30%.[(3)]

Materials and methods

All non-duplicate isolates of *Steptococcus pneumoniae* between November 2021 to December 2024 from sputum samples were considered in the study. A direct smear examination of the sputum sample by Gram's stain was done for all samples to test the adequacy of sample and also to correlate the microscopy with culture reports. The isolates were identified on Vitek2 Compact®, along with Optochin sensitivity testing. QC of Vitek cards was done as per CLSI guidelines. Antimicrobial susceptibility testing was performed using the ST03 cards of Vitek. The CLSI 2024 guidelines were used for result interpretation. We had 115 such isolates of Streptococcus pneumoniae from sputum samples in that time period. 8 of those isolates had one or more drugs terminated and so were not included in the study. The CLSI 2024 guidelines were used for result interpretation. For Benzylpenicillin, Cefotaxime and Ceftriaxone, non-meningitis breakpoints were considered. The patients' ages ranged from 21-80 years.

Results

Out of 107 isolates, 100 (93.45%) were susceptible to Benzylpenicillin, 3 were Intermediate and 4, Resistant. More than 95% of isolates were susceptible to Cefotaxime and Ceftriaxone. 65.4% (70/107) of strains were Susceptible to Levofloxacin, and 75.7% (81/107) to Moxifloxacin. 100% of the isolates were susceptible to Vancomycin, Linezolid and Tigecycline. 98.1% (105/107) were susceptible to Rifampicin. Only 29.9% and 27% were susceptible to Tetracycline and Cotrimoxazole respectively. The most shocking results were observed for Erythromycin. 99/107 i.e, 92.5% of the strains were Resistant to Erythromycin. Only a meagre 8/107 isolates were sensitive, with MIC values <= 0.12mcg/ml. Efflux pump (49/99) and MLSB (50/99) phenotypes accounted for approximately 50% each to the resistance mechanism noted on the Advanced Expert system of Vitek2 Compact® based on the phenotypic evaluation of the strains tested.

Antibacterial susceptibility of Streptococcus pneumoniae isolates (107)				
Antimicrobial/ Interpretation	**Sensitive (n)**	**Sensitive %**	**Intermediate (n)**	**Resistant (n)**
Benzylpenicillin	**100**	**93.45%**	**3**	**4**
Ceftriaxone	**103**	**96.2%**	**2**	**2**
Cefotaxime	**102**	**95.3%**	**3**	**2**
Levofloxacin	**70**	**65.4%**	**3**	**24**
Moxifloxacin	**81**	**75.7%**	**7**	**9**
Vancomycin	**107**	**100%**	**0**	**0**
Linezolid	**107**	**100%**	**0**	**0**
Tigecycline	**107**	**100%**	**0**	**0**
Rifampicin	**105**	**98%**	**0**	**2**
Tetracycline	**32**	**29.9%**	**2**	**73**
Cotrimoxazole	**29**	**27%**	**24**	**44**
Erythromycin	**99**	**92.5%**	**0**	**8**
Efflux pump	**49/99**	**49.4%**	**-**	**-**
MLSB	**50/99**	**50.5%**	**-**	**-**

Discussion

Macrolides have always been the mainstay of treatment of CAP in the Outpatient set-up as well as in the hospitalized patient population. Several factors have earned this agent a pride of place on the pharmacy shelves. Oral bioavailability, single daily dosing, safety in paediatric population, high concentrations achievable in lungs, and its activity on atypical bacterial agents of pneumonia like Leigonella spp. being some of the advantages of using them.[4] With recent trends in rising resistance, ICMR in its 2022 guidelines, stated that Azithromycin be used along with Co-amoxiclav for treatment of CAP in patients with comorbidities. But, with the resistance rates of 92.5% can Azithromycin still be a choice in CAP patients? Is it not time we bade adieu to this antimicrobial which served its purpose for more than four decades. Upto 60% resistance to Macrolides had been reported in a multi-centric study conducted in India between 2015-2020.[4]

The entry of the new champion Nafithromycin could not have been better timed. It's a novel lactone-ketolide. It is India's first indigenously developed Antimicrobial and also the country's first FDA approved antibiotic. Nafithromycin was launched on November 20th, 2024 by the Union Minister Dr Jitendra Singh after completion of Phase III clinical trials in India.[5] It is said to achieve very high concentrations in the lung as well as alveolar macrophages. Single daily dosing for just three days, and high efficacy even against MDR *S.pneumoniae* isolates, that are resistant to macrolides too, are its distinctive features. Hope the new entry to the block can continue to be a game changer drug for a substantial amount of time.

Reference

1. Varghese R, Daniel JL, Neeravi A, Baskar P, Manoharan A, Sundram B, Manchanda V, Saigal K, Yesudhasan BL, Veeraraghvan B. Multicentric Analysis of Erythromycin Resistance Determinants in Invasive Streptococcus pneumoniae; Associated Serotypes and Sequence Types in India. Curr Microbiol. 2021 Aug;78(8):3239-3245. doi: 10.1007/s00284-021-02594-7. Epub 2021 Jul 5. PMID: 34223923.
2. Vikhe V B, Faruqi A A, Patil R S, et al. (July 06, 2024) A Systematic Review of Community-Acquired Pneumonia in Indian Adults. Cureus 16(7): e63976. doi:10.7759/cureus.63976.
3. ICMR 2022 Treatment Guidelines for Antimicrobial Use in Common Syndromes https://amrtg.icmr.org.in/chapter 4-cap -treatment - guideline.html.
4. Balaji Veeraraghavan, Rosemol Varghese, Karnika Saigal, S Balasubramanian, P Sulochana Putli Bai, Binesh Lal Y, Ayyanraj Neeravi, Pavithra Baskar, Kavipriya Anandhan, C P Girish Kumar, Yuvraj Jayaraman, Vijaya Lakshmi Nag, Sujata Baveja, Bhavana J, Shrikrishna A Joshi, Ranganathan Iyer, Activity of novel lactone ketolide nafithromycin against multicentric invasive and non-invasive pneumococcal isolates collected in India, JAC-Antimicrobial Resistance, Volume 3, Issue 2, June 2021, dlab066, https://doi.org/10.1093/jacamr/dlab066.
5. Bhawsar, S., Tadiparthi, R., Kayastha, A.K. et al. Nafithromycin (MIQNAF®): ultramodern lactone ketolide designed to treat community acquired bacterial pneumonia (CABP). Med Chem Res 33, 1715 –1733 (2024). https://doi.org/10.1007/s00044 - 024 -03281-5.

Mental Health

Holistic Approach to Tackling Antimicrobial Resistance

Dr Samir Parikh

Consultant Psychiatrist
Chairperson - Fortis National Mental Health Program
Fortis Healthcare

Antimicrobial resistance is one of the leading challenges in health care. They have been built by an excessive or inappropriate usage of medicines that are supposed to protect us against all those ailments. Misinformation is part of this; there are many who, with reference to some online source, will say that they can use antibiotics in any kind of infection. Others discontinue medication thinking they are well and do not realize this leads to stronger drug upping microbes.

Psychoeducation or making people understand why treatment is important plays an important role here. For example, a frightened parent who just doesn't know whether their sick child's temperature is a cue for antibiotic treatment. In this scenario, just a clear and compassionate explanation would go a long way into modifying behavior, if they're going to change it. Patients need to understand the importance and how skipping doses can harm their health-and even endanger that of others-to date.

Another problem is anxiety. Some patients dread the side effects or simply do not have confidence in the medicine. Reassurance and education will help conquer the fears of patients-most especially children, the elderly, or patients suffering from a mental health illness. The psychiatrist would most likely help explain treatment in simple terms, soothe fears, and guide change in behaviour that promotes better health habits.

Liaison medicine can take this one step further by linking mental and physical health care. Hence, with the cooperation amongst the infectious disease teams, psychiatrists and other experts will ensure a treatment protocol personalized to avoid harmful side effects and keeping patients' adherent to their prescriptions.

AMS @ Fortis

Antibiogram and its Clinical Significance

Dr Sheetal Sawant

Sr. Microbiologist & ICO Agilus Diagnostic
Fortis Hospital, Mulund

The antibiogram is a periodic profile of antimicrobial susceptibilities of various organisms isolated from patients. It is commonly utilized to monitor recent antimicrobial susceptibility patterns in order to guide empirical antimicrobial therapy. Antibiograms can also be used to compare susceptibility rates across institutions and track resistance trends. The clinical microbiology laboratory plays a critical role in formulating antibiograms and providing patient specific culture and susceptibility data.

Components of the antibiogram include organism names, number of isolates analysed and antimicrobial agents tested .The percentage of susceptibility of each organism is interpreted as per CLSI recommended breakpoints.

There are different modalities of antibiogram presentation. The data can be stratified based on site of infection (e.g. urine, blood, pus isolate), hospital unit (e.g. ICU, emergency department) and/or specific patient populations (eg, Hemat-oncology patients). This kind of presentation gives more specific information.

The antibiogram preparation is currently based on CLSI M39, entitled "Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data". Below mentioned points are considered for antibiotic preparation:

- The data should be analysed annually. However, if there are a large number of isolates, this may be done six monthly or more frequently.
- At least 30 isolates should be present for inclusion in the analysis. The predictive value of antibiograms will diminish if smaller samples sizes is used.
- The isolates that are obtained from diagnostic testing should only be included and those from surveillance cultures, e.g., MRSA screening should not be included. Colonisers should not be included. The inclusion of colonizing organisms in the percentage susceptibility calculation may influence susceptibility rates.
- Include results for the antibiotics that are routinely tested.
- Only the first isolate from a patient irrespective of the specimen site should be included. The microbiology data can be collected by manual data collection and the use of analytical surveillance software eg. WHONET or by using Agilus laboratory software CLIMS.

The antibiograms are shared with all stakeholders and also made available on hospital intranet. Antibiograms are used to make the Hospital Antibiotic policy which is reviewed annually based on the antibiogram.

Antibiograms along with antibiotic consumption data are shared annually with MSOG for DRI Calculation. Individual DRI (Drug resistance index) is shared to all hospitals and DRI of hospitals is tracked by MSOG. (for more details on DRI – read the next article)

The importance of detection of resistance genes has gone beyond epidemiological surveillance. The therapy of many ICU patients is based on resistance gene pattern. With the availability of rapid diagnostics such as MALDI-TOF and nucleic acid amplification tests, we will have more defined antibiogram in the future.

Drug Resistance Index: An Innovative Estimate!

Dr Anita Arora

Director - Medical Operations, MSOG
Group Head - Infection Prevention and Control
Fortis Corporate Office

The **Drug Resistance Index (DRI)** was introduced around a decade ago by researchers at CDDEP (Center for Disease Dynamics, Economics and Policy*) as an easy-to-understand measure of the effectiveness of antimicrobial therapy. It is a composite measure used to evaluate the relationship between **antimicrobial use** and **antimicrobial resistance** in clinical practice.

DRI is a relative value indicating the overall susceptibility of a particular microorganism to the basket of antibiotics available to treat it. This index expresses the antibiotic resistance and antibiotic use relationship on a **scale of 0 to 1**.

- **A value of 1** means that infections (of that particular microorganism) are untreatable with any of the available antibiotics used in the given setting.
- **A value of 0** means all isolates of the microorganism included in the calculation are susceptible and treatable.
- **Values between 0 to 1** express overall susceptibility of infections, adjusted for local prescribing practices – with values nearing 0 being most susceptible to treatment.

The strength of this index is that it makes comparisons over both time and location substantially easier.

For example, an increase in the DRI of E. coli from 0.56 to 0.6 over a defined period of time (e.g. a year) in a hospital, suggests that infections caused by E. Coli have become more difficult to treat, considering any changes in prescribing patterns.

DRI is reported at the hospital level and measured in three simple steps:

- Preparing resistance data (antibiogram)
- Preparing utilization data (antibiotic consumption)
- Collating information and calculating DRI

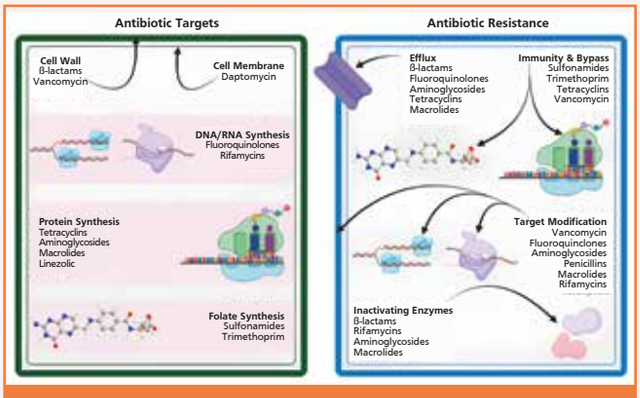
The Fortis Experience

At Fortis, the DRI calculation is done on an annual basis by using the pharmacy and antibiogram data provided by each hospital. Since 2015 the DRI value is provided every year to each hospital team for them to internally deliberate on the value and the trend. Learnings from unit discussions are used to influence prescription practices and promote rational use of antimicrobials. The yearly DRI value calculation and the ensuing discussion has enabled our units to make efforts towards strengthening their AMS program, improving its compliance and its effectiveness.

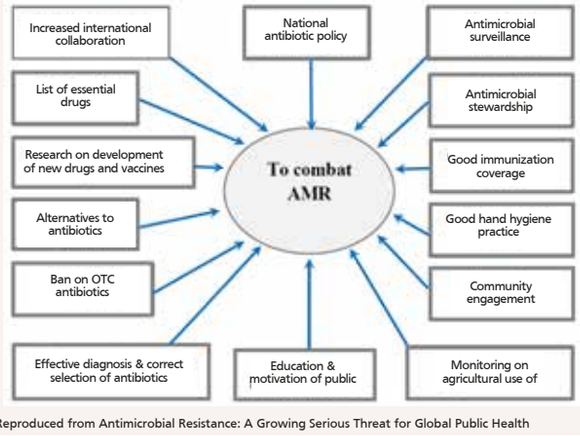
Way forward and future steps

Though DRI has been around for a while, limited data is available on how to favourably influence antibiotic resistance rates of microorganisms. We believe that as more information becomes available a much clearer picture will emerge for managing the antibiotic resistance level and consumption of antimicrobial agents in a hospital based on the analysis of the drug resistance index.

**renamed One Health Trust*



Antibiotic targets and mechanisms of drug resistance



*Reproduced from Antimicrobial Resistance: A Growing Serious Threat for Global Public Health

Major interventions to combat AMR

The following table illustrates the Drug Resistance Index (DRI) for 24 FHL units from 2016 to 2023. The data includes calculations for the Total DRI, Restricted Antimicrobials DRI, and the DRI specific to Gram-negative bacteria, namely *E. coli, K. pneumoniae, P. aeruginosa, and A. baumannii.*

Units	Total DRI							
	2016	2017	2018	2019	2020	2021	2022	2023
UNIT A	0.54	0.54	0.68	0.47	—	0.73	0.55	0.67
UNIT B	0.51	0.45	0.49	0.47	0.42	0.47	0.36	0.44
UNIT C	0.4	0.51	0.48	0.47	0.45	0.48	0.48	0.39
UNIT D	0.6	0.59	0.59	0.49	0.4	0.35	0.40	0.45
UNIT E	0.6	0.69	0.5	0.6	—	—	0.22	0.63
UNIT F	0.4	0.47	0.48	0.48	0.54	0.5	0.48	0.39
UNIT G	—	—	—	—	—	—	—	0.63
UNIT H	—	—	—	—	—	0.38	0.38	0.34
UNIT I	0.37	0.46	0.4	0.47	0.43	0.5	0.46	0.55
UNIT J	0.6	0.53	0.58	0.58	0.59	0.54	0.63	0.62
UNIT K	NA	NA	NA	0.58	—	0.6	0.56	0.58
UNIT L	—	—	—	—	—	0.22	0.26	0.35
UNIT M	0.57	0.46	0.55	0.55	0.54	0.52	0.58	0.52
UNIT N	0.5	0.46	0.41	0.36	0.45	0.43	0.34	-----
UNIT O	0.63	0.64	0.55	0.63	0.67	0.57	0.60	0.61
UNIT P	0.48	0.5	0.59	0.59	0.62	0.51	0.30	0.57
UNIT Q	0.49	0.49	0.44	0.29	0.36	—	0.37	0.44
UNIT R	0.54	0.57	0.62	0.62	0.54	0.54	0.46	0.37
UNIT S	—	—	—	—	—	0.48	0.07	-----
UNIT T	—	—	—	—	—	0.52	0.53	0.15
UNIT U	0.5	0.39	0.62	0.53	0.18	0.11	0.62	0.64
UNIT V	0.37	0.38	0.4	0.39	—	0.48	0.44	-----
UNIT W	0.53	0.39	0.42	0.44	0.43	0.44	0.51	0.56
UNIT X	0.63	0.58	0.6	0.66	0.71	0.66	0.69	0.70

Units	Restricted DRI							
	2016	2017	2018	2019	2020	2021	2022	2023
UNIT A	0.2	0.19	0.59	0.34	—	0.40	0.40	0.45
UNIT B	0.21	0.24	0.33	0.38	0.29	0.39	0.26	0.26
UNIT C	0.07	0.14	0.22	0.17	0.14	0.16	0.16	0.12
UNIT D	0.09	0.16	0.29	0.15	0.22	0.22	0.47	0.34
UNIT E	0.2	0.38	0.25	0.22	—	—	0.19	0.20
UNIT F	0.16	0.21	0.29	0.29	0.36	0.31	0.24	0.31
UNIT G	—	—	—	—	—	—	—	0.40
UNIT H	—	—	—	—	—	0.20	0.08	0.23
UNIT I	0.09	0.14	0.26	0.38	0.41	0.25	0.21	0.29
UNIT J	0.21	0.14	0.37	0.39	0.37	0.30	0.63	0.37
UNIT K	NA	NA	NA	0.26	—	0.27	0.21	0.22
UNIT L	—	—	—	—	—	0.12	0.38	0.31
UNIT M	0.18	0.18	0.24	0.24	0.25	0.21	0.21	0.24
UNIT N	0.08	0.08	0.22	0.16	0.19	0.44	0.13	-----
UNIT O	0.29	0.22	0.26	0.35	0.3	0.25	0.34	0.28
UNIT P	0.16	0.24	0.17	0.19	0.3	0.25	0.65	0.24
UNIT Q	0.1	0.11	0.26	0.34	0.13	—	0.12	0.20
UNIT R	0.27	0.23	0.39	0.37	0.33	0.32	0.24	0.17
UNIT S	—	—	—	—	—	0.18	0.27	-----
UNIT T	—	—	—	—	—	—	—	0.04
UNIT U	0.2	0.16	0.37	0.32	0.16	0.14	0.26	0.23
UNIT V	0.13	0.14	0.2	0.22	—	0.26	0.12	-----
UNIT W	0.18	0.14	0.14	0.16	0.18	0.15	0.35	0.51
UNIT X	0.39	0.31	0.37	0.38	0.39	0.38	0.42	0.50

Units	GNB							
	2016	2017	2018	2019	2020	2021	2022	2023
UNIT A	0.62	0.64	0.68	0.57	—	0.77	0.69	0.73
UNIT B	0.57	0.46	0.58	0.57	0.52	0.53	0.40	0.47
UNIT C	0.41	0.55	0.49	0.49	0.49	0.52	0.53	0.43
UNIT D	0.66	0.61	0.66	0.53	0.46	0.35	0.25	0.50
UNIT E	0.62	0.72	0.61	0.64	—	—	0.23	0.20
UNIT F	0.46	0.57	0.53	0.56	0.65	0.58	0.54	0.42
UNIT G	—	—	—	—	—	—	—	0.66
UNIT H	—	—	—	—	—	0.43	0.43	0.37
UNIT I	0.4	0.53	0.26	0.38	0.41	0.25	0.49	0.62
UNIT J	0.69	0.6	0.37	0.39	0.37	0.30	0.69	0.65
UNIT K	NA	NA	NA	0.26	—	0.27	0.61	0.60
UNIT L	—	—	—	—	—	0.12	0.38	0.39
UNIT M	0.64	0.49	0.56	0.58	0.56	0.52	0.63	0.58
UNIT N	0.54	0.51	0.43	0.38	0.46	0.45	0.35	-----
UNIT O	0.65	0.7	0.59	0.68	0.75	0.64	0.66	0.68
UNIT P	0.57	0.6	0.65	0.64	0.66	0.53	0.69	0.61
UNIT Q	0.5	0.47	0.53	0.34	0.36	—	0.41	0.46
UNIT R	0.58	0.58	0.64	0.64	0.55	0.56	0.50	0.39
UNIT S	—	—	—	—	—	0.49	0.28	-----
UNIT T	—	—	—	—	—	0.68	0.56	0.18
UNIT U	0.5	0.39	0.62	0.58	0.16	0.14	0.70	0.70
UNIT V	0.42	0.45	0.52	0.45	—	0.52	0.49	-----
UNIT W	0.59	0.44	0.44	0.47	0.49	0.46	0.54	0.58
UNIT X	0.72	0.69	0.68	0.76	0.77	0.8	0.75	0.76

Accreditation and AMS

Role of Accreditation in Antimicrobial Stewardship Program

Dr Narayan Pendse
Vice President - Medical Strategy and Operations
Fortis Corporate Office

Dr Akash Sud
Head Clinical Governance – Medical Strategy and Operations
Fortis Corporate Office

Dr Sukriti Sud
Assistant Manager – Medical Strategy and Operations
Fortis Corporate Office

To promote rational use of antimicrobials, reduce antimicrobial resistance (AMR), and enhance patient safety, accreditation bodies like NABH and JCI include AMS as an important component in their standards. Accreditation helps ensure that hospitals follow AMS guidelines which include monitoring antimicrobial use, maintaining antibiograms, and preventing misuse of antimicrobials.

NABH has recently launched the 6th Edition of Hospital Accreditation Standards. With respect to AMS, these standards require a dedicated Antimicrobial Stewardship Committee (ASCC), with defined roles for healthcare professionals, to oversee the rational use of antimicrobials. Through various requirements captured as part of accreditation Standards/Objective Elements, Key Performance Indicators (KPI) and Quality Indicators (QI), NABH promotes structured implementation of AMS programs and helps hospitals align with national and global AMR action plans.

Accreditation requirements as laid down in 6th Edition of NABH Hospital Standards are listed below:

1. STANDARD AND OBJECTIVE ELEMENTS

[CHAPTER] Infection Prevention and Control (IPIC)

[STANDARD] IPC.3: The organization implements infection prevention and control processes in clinical areas

[OBJECTIVE ELEMENT] IPC 3e [COMMITMENT]: Appropriate Antimicrobial Usage Policy is established and documented

Interpretation: The organization should monitor the policies for restricted antimicrobial use. There must be documentation of ordering processes and the use of restricted antimicrobials by clinical teams.

The organization must identify clinical conditions for using various antimicrobial agents, including: Anti-tubercular agents, anti-fungal agents, anti-viral agents, and anti-parasitic agents.

Key aspects to define include:

1. Type of antimicrobial agent.
2. Monotherapy vs combination therapy.
3. Escalation and de-escalation protocols.
4. Dose and duration of therapy.
5. A system must be developed for monitoring site-specific antibiograms and antimicrobial susceptibility (based on culture sensitivity).
6. The policy should be reviewed periodically (at least annually) to ensure applicability.

[CHAPTER] Infection Prevention and Control (IPIC)

[STANDARD] IPC.3: The organization implements infection prevention and control processes in clinical areas.

[OBJECTIVE ELEMENT] IPC 3f [CORE]: The organisation

implements the antimicrobial stewardship program and monitors the use of antimicrobial agents.

Interpretation: Antimicrobial agents must be prescribed as per the organization's policy. A mechanism for ordering restricted antimicrobial agents must be implemented. Deviations are be brought to the notice of concerned clinicians, with corrective and preventive actions documented.

Monitoring of the appropriate use of restricted antimicrobial agents is essential. Antimicrobial stewardship programme shall be monitored by an antimicrobial stewardship forum consisting of clinicians.

Purpose of the Antimicrobial Stewardship Programme is to guide efforts to improve appropriate and necessary antimicrobial use. Shall include leadership commitment, accountability, drug expertise. action, tracking, and reporting, education.

The organization generates awareness among healthcare providers and the community regarding AMR (Antimicrobial Resistance) 2017–2021 and promotes the rational use of antimicrobials.

References

- WHO-2011 guidelines for antimicrobial policies.
- Ministry of Health's National Treatment Guidelines for Antimicrobial Use in Infectious Diseases.
- Indian Council of Medical Research's (ICMR) Treatment Guidelines for Common Syndromes.

Additional Guidelines

- National and international professional societies' guidelines may also be referred to.
- A standardized methodology for antimicrobial susceptibility testing is recommended.
- Identify restricted antimicrobial agents, including audits and formulary restrictions.
- The list of restricted antimicrobials shall adhere to WHO's AWaRe classification.

2. QUALITY INDICATORS

S.No.	AMS Quality Indicators	Type
1	Antibiotic prescribing adherence	Process
2	Preauthorization and review	Process
3	Empiric therapy appropriateness	Process
4	De-escalation of therapy	Process
5	Documentation of indication	Process
6	Duration of therapy adherence	Process
7	Pharmacy interventions	Process
8	Diagnostic testing before prescription	Process
9	Education and training participation	Process
10	Antibiotic consumption (DDD/DOT)	Outcome
11	Antimicrobial resistance rates	Outcome
12	Clinical outcomes (mortality, LOS)	Outcome
13	Rate of Clostridioides Difficile Infection (CDI)	Outcome
14	Antibiotic-related adverse events	Outcome
A15	Cost savings (antimicrobial expenditure)	Outcome
16	Readmission rates due to infection	Outcome
17	AMSP leadership presence	Structural
18	Guidelines and policies availability	Structural
19	Access to diagnostic support	Structural
20	Regular reporting of AMS data	Monitoring/Reporting
21	Feedback to prescribers	Monitoring/Reporting
22	Audit and feedback	Monitoring/Reporting

3. KEY PERFORMANCE INDICATORS

Key Performance Indicators (KPIs) that support the Antimicrobial Stewardship program:

Key Performance Indicator					
Indicator	**Description**	**Formula**	**Frequency**	**Remarks**	**HIS EMR System Guide**
PSQ 3b	Percentage of cases who receive appropriate prophylactic antibiotics within the specified time frame	(Number of patients who did receive appropriate prophylactic antibiotic (s) ÷ Number of patients who underwent surgeries) × 100	Monthly	Appropriate prophylactic antibiotic as per hospital policy. • Includes patients who received the correct drug and dose within the specified time. • Patients not given antibiotics because they were not indicated (e.g., clean surgeries) are also included in the numerator.	The system shall calculate the number of patients who did receive appropriate prophylactic antibiotic(s) until midnight of the last day of calendar of the month. The system shall calculate the total number of patients who underwent surgeries until midnight of the last day of the calendar month.

4. GUIDELINE FOR AMS

Guidelines and Action Plan for implementing Antimicrobial Stewardship Program (AMS)

The guidelines advocate for evidence-based, collaborative approaches involving healthcare teams to ensure rational antimicrobial use while addressing emerging resistant pathogens. AMS benefits extend beyond hospitals to public health, curbing infections and improving overall health outcomes.

Key components include the formation of a multidisciplinary Antimicrobial Stewardship Core Committee (ASCC); integrating expertise from clinical microbiology, pharmacy, quality teams, and nursing leadership; regular Continuing Medical Education (CME) sessions, workshops, and public awareness campaigns on antimicrobial misuse.

Metrics such as Defined Daily Dose (DDD) and Days of Therapy (DOT) are employed to monitor antimicrobial usage, while Drug Resistance Index (DRI) measures microbial susceptibility trends. Antibiograms, prepared periodically, summarize pathogen resistance patterns, aiding evidence-based clinical decisions. A key aspect is the tracking of antimicrobials through dedicated software integrated into hospital information systems, ensuring data confidentiality and preventing misuse.

NABH 6th Edition can be referenced for details.

Six strategic priorities in national action plan for antimicrobial resistance in India

What's New for AMS Program in JCI 8th Edition

Dr Supriya Amey
Medical Director
Fortis Hospital, Mulund

Shalini Sharma
Head - Quality & Patient Safety
Fortis Hospital, Mulund

Joint Commission International released 8th Edition Accreditation Standards for Hospitals & Academic Medical Centers on 1st July 2024 which shall be effective from 1st January 2025. This new edition introduces several updates, including two additional chapters. It also shifts the focus of the Antimicrobial Stewardship Program in Medication Management & Use (MMU) chapter from definition to action, offering practical strategies for its effective implementation.

MMU.01.01 highlights Antimicrobial Resistance (AMR) as urgent public health and socioeconomic concern by citing recent data of 5 million deaths in 2019, and being listed as one of the top 10 global health threats in 2022. There are 4 new Measurable Elements (MEs) are added to MMU.01.01 describing details in the intent.

ME 1: ®The hospital implements a written program for antimicrobial stewardship that is based on scientific evidence, accepted clinical practice guidelines, and local laws and regulations and, at minimum, includes the following:

- Documentation indicating that the scope of the antimicrobial stewardship program includes the entire hospital and all services associated with the hospital.
- Implementation of at least two evidence-based clinical practice guidelines to improve antimicrobial use for the most common indications.
- Evaluation of adherence to at least one of the evidence-based clinical practice guidelines the hospital implements (including antimicrobial selection and duration of therapy, where applicable).

Hospitals must select at least 2 infections and define evidence based clinical practice guideline (CPG) to optimize and improve the antimicrobial use for common infections. The intent states that the guidelines can be defined for selected or high-risk infections such as sepsis, pneumonia, endocarditis, meningitis, UTI and MDRO. Hospital policy must be documented and also mentions how CPGs are monitored and evaluated.

ME 2: The hospital has an interdisciplinary team that oversees the antimicrobial stewardship program. The interdisciplinary team is defined and includes, at minimum, an infection prevention and control professional, a physician, a nurse, a pharmacist, and hospital leaders. This defines the composition of AMS team which is the new update in comparison to previous edition.

The intent mentions various strategies to optimize antimicrobial prescribing include the following:

- Preauthorization for general and specific antimicrobial use that includes an internal review and approval process prior to use.
- Prospective review and feedback regarding antimicrobial prescribing practices, including the treatment of positive blood cultures, by a member of the antimicrobial stewardship program.
- Tracking, trending, and analysis of multidrug-resistant organism occurrences.
- Tracking, trending, and analysis of prescription patterns and amount used of the restricted antimicrobials on the hospital's list. This edition focuses on tracking antibiotic consumption which is a new highlight.

ME 3: The antimicrobial stewardship program demonstrates coordination among all components of the hospital responsible for antimicrobial use and resistance, including but not limited to the infection prevention and control program, the quality and patient safety program, the medical staff, nursing services, and pharmacy services.

ME 6: ®The antimicrobial stewardship program collects, analyzes, and reports data to hospital leaders, medication interdisciplinary committee, infection prevention and control department, quality improvement department, pharmacy leaders, all staff, and other stakeholders per hospital policy.

The intent mentions way to track the effectiveness of the program is an important element of the program's success. Examples of data that can help measure effectiveness include the following:

- All antimicrobial use (general and restricted).Lorem

- Evidence of a decrease in the inappropriate use of antimicrobials and a decrease in multidrug-resistant organisms.
- Documentation that prescribers are following accepted clinical practice guidelines.
- Appropriate optimal use of prophylactic antimicrobials.
- Monitoring Clostridioides difficile trends as a surrogate marker.
- Developing a list of restricted antimicrobials and monitoring prescription pattern and amount used

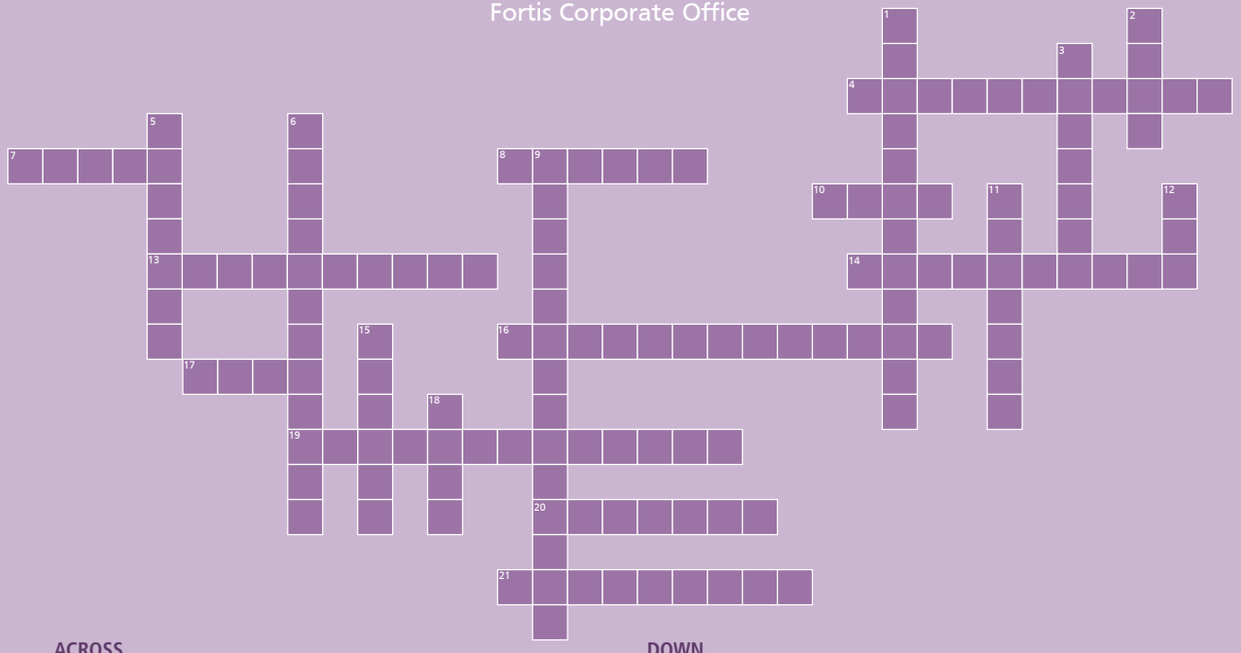
This emphasizes that healthcare organizations are expected to leverage data to enhance the performance of antimicrobial stewardship programs. Coordination with other teams, such as infection control and prevention, quality and patient safety, medical and nursing staff, pharmacy services, and leadership, is essential. Hospital policies must clearly define what data is collected, how it is analyzed and utilized, and how it is reported.

ME 8: Patients and families receive education on the antimicrobial stewardship program and on the appropriate use of antimicrobials.

TRIVIA

Crossword

Dr Sukriti Sud
Assistant Manager – Medical Strategy and Operations
Fortis Corporate Office



ACROSS

4. The ability of microorganisms to respond to antimicrobial agents, determined through testing.
7. Inhibitor that works against beta-lactamase enzymes to protect beta-lactam antibiotics.
8. Broad-spectrum antibiotics, including carbapenems, used for severe infections.
10. Global initiative to raise awareness about antibiotic resistance.
13. Minimum Inhibitory Concentration
14. A class of broad-spectrum antibiotics used for multi-resistant bacterial infections.
16. India's first indigenous Macrolide antibiotic.
17. Resistance Index: Drug _____ Index
19. A genus of bacteria known for causing infections in hospital settings, resistant to many antibiotics.
20. The process of growing microorganisms in a controlled environment to identify the cause of an infection.
21. A beta-lactamase inhibitor often combined with beta-lactam antibiotics to enhance efficacy.

DOWN

1. Adjusting antibiotic treatment to narrower-spectrum drugs after identifying the causative pathogen.
2. Steward _____
3. A rapid diagnostic test to detect pathogens and antibiotic resistance profiles.
5. A cluster of microorganisms that adhere to surfaces, embedded in a protective matrix.
6. A profile that identifies bacterial species and their antibiotic resistance patterns.
9. CEFEPIME+_____
11. Circular DNA in bacteria that carries genes, including those for antibiotic resistance.
12. New Delhi Metallo-beta-lactamase
15. Daily Dose: DDD is a standardised unit for measuring daily antibiotic consumption in adults.
18. Lactamase: Extended Spectrum _____ consists of enzymes produced by bacteria that confer resistance to certain antibiotics

Happenings @ Fortis

Highlights from World Antimicrobial Awareness Week 2024

Fortis healthcare actively participated in the global campaign for world antimicrobial awareness week (WAAW) from 18th to 24th November 2024, focusing on raising awareness about antimicrobial resistance (AMR) and promoting best practices. WAAW 2024 at Fortis Healthcare was a success, marked by enthusiastic participation. By educating communities, advocating for AMR awareness, and taking immediate action, Fortis leadership reiterated the need for combating antimicrobial resistance while inspiring a culture of stewardship and responsibility.

This Year's Theme, **"Educate. Advocate. Act Now."** emphasized the need to inform stakeholders about AMR, advocate for bold commitments, and take key action. Here's a snapshot of the impactful activities conducted during World Antimicrobial Awareness Week (WAAW) across the Fortis Network:

Pamphlets and audio-visual videos were actively shared on Instagram, Facebook, and other social media platforms to create a broad digital footprint.

All Fortis OPD pharmacies dispensed medications in specially designed paper envelopes displaying AMR dos and don'ts, directly educating patients.

Training sessions on AMR awareness were conducted with corporates like Airtel, SBI, and Honda, receiving positive feedback.

On-Ground Hospital Activities: AMR awareness posters were displayed at OPD counters. Awareness campaigns included surveys, patient and family education leaflets, healthcare professional training, and engaging activities like *nukkad nataks* and hoardings.

Educate:

- AMR surveys, with the Mumbai Cluster alone surveying 4,511 participants, featured in the Times of India to promote responsible antibiotic use.
- Radio broadcasts and live sessions.
- Training programs for employees, corporates, schools, and NGOs.

Advocate:

- Pledges for AMR awareness.
- "Go Blue" solidarity campaign
- Creation of "Reels of Change" for social media.

Act Now:

- Med Drop Zones for unused medications were set up.

This week-long effort successfully combined education, advocacy, and action to promote AMR awareness and drive impactful change.

Antimicrobial WAAW Week Celebration across Fortis Network

New Kid on the Block

Cefepime Enmetazobactam

Source: Drugs. 2024 Jun;84(6):737-744. doi: 10.1007/s40265-024-02035-2. Epub 2024 May 18.

Cefepime/enmetazobactam - an intravenous (IV) antibacterial fixed-dose combination of a 4th generation cephalosporin and an extended-spectrum β-lactamase (ESBL) inhibitor, recommended for treatment of infections caused by multi-drug-resistant (MDR) **Gram-Negative bacteria.**

1. Clinical Indication

Approved in US

Adults with complicated urinary tract infections (CUTI) including pyelonephritis, caused by susceptible strains of *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus mirabilis, and Enterobacter cloacae complex.*

Approved in the EU

- In adults for the treatment of cUTI, including pyelonephritis, and hospital-acquired pneumonia, including ventilator associated pneumonia.
- Treatment of patients with bacteremia occurring in association with or suspected to be associated with any of these infections.

Cefepime-enmetazobactam is intended as a therapy for infections by ESBL-, AmpC-, and OXA-48-producing strains of Enterobacteriaceae and by *Pseudomonas aeruginosa*. It is expected to provide an empirical treatment option in settings with a high incidence of ESBL producing Enterobacteriaceae that pursue carbapenem-sparing strategies.

2. Mechanism of action

1. The cefepime component is a cephalosporin antibacterial drug.
- Cefepime is a fourth-generation cephalosporin stable to hydrolysis by some beta-lactamases, including penicillinases and cephalosporinases produced by gram-negative and gram-positive bacteria, with the exception of extended spectrum beta-lactamases (ESBL), some oxacillinases, and carbapenem hydrolyzing beta-lactamases.
- The bactericidal action of cefepime results from the inhibition of cell wall synthesis.
- Cefepime penetrates the cell wall of most gram positive and gram-negative bacteria to bind penicillin-binding protein (PBP) targets.

2. The enmetazobactam component is a beta-lactamase inhibitor (BLI) that protects cefepime from degradation by certain serine beta-lactamases such as ESBL.
- Enmetazobactam is a novel ESBL inhibitor. It exerts potent inhibitory activity toward CTX-M, TEM, SHV, and other class A β-lactamases (except for KPC) through a different mechanism of action than tazobactam.
- It does not inhibit class B and D β-lactamases and carbapenemases.

Against a collection of cefepime non-susceptible Enterobacteriaceae, the combination of enmetazobactam with cefepime demonstrated *in vitro* and *in vivo* activity comparable to that of meropenem.

3. Mechanisms of resistance

- Production of beta-lactamases that are not inhibited by enmetazobactam
- Modification of PBPs by target alteration
- Overexpression of efflux pumps
- Outer membrane porin mutations
- Clinical isolates may produce multiple beta-lactamases, express varying levels of beta-lactamases, or have amino acid sequence variations, and other resistance mechanisms that have not been identified.

Culture and susceptibility information and local epidemiology should be considered in selecting or modifying antibacterial therapy.

4. AST testing

EUCAST break points (May 2024)

Cefepime-enmetazobactam: S≤4, R>4 mg/L. *Disk diffusion criteria and QC targets and ranges are likely to be published shortly.*

FDA (2024)
For disk diffusion, use paper disks impregnated with 30/20 mcg cefepime/enmetazobactam.

Pathogen	Minimum inhibitory concentration (mcg/mL)				Disk diffusion (zone diameter in mm)				
	S	SDD	I	R	S	SDD	I	R	
Enterobacterales	<=8/8	-	-	>=16/8	>=21	-	-	<=20	
Pseudomonas aeruginosa	<=8/8	-	-	>=16/8	>=18	-	-	<=17	

5. Clinical indications & experience

This drug should be used only to treat infections that are proven or strongly suspected to be caused by susceptible bacteria.

1. Among patients with complicated UTI or acute pyelonephritis due to gram-negative pathogens, cefepime/enmetazobactam, compared with piperacillin/tazobactam, met criteria for noninferiority as well as superiority with respect to the primary efficacy outcome of clinical cure and microbiological eradication. Additionally, cefepime/enmetazobactam was superior to piperacillin/tazobactam for the primary outcome. These findings suggest that cefepime/enmetazobactam may be an appropriate empirical therapy for suspected gram-negative complicated UTI. (JAMA. 2022;328(13):1304-1314. doi:10.1001/jama.2022.17034)
2. Piperacillin-tazobactam is a carbapenem-sparing option for infections caused by ESBL-producing *E.coli* and *K. pneumoniae.* However, the outcomes from the recent MERINO study do not support piperacillin-tazobactam as an alternative to meropenem in patients with bloodstream infections caused by ceftriaxone-resistant *E. coli or K.pneumoniae.*

   Applying the CLSI breakpoint for cefepime to cefepime-enmetazobactam revealed that this novel β-lactam/β-lactamase inhibitor combination outperformed piperacillin-tazobactam and was as potent as meropenem toward the complete Enterobacteriaceae panel and toward the subset of ESBL-producing E. coli and K. pneumoniae isolates, though it showed limited activity against KPC-producing Enterobacteriaceae.

   The addition of enmetazobactam also enhanced substantially the in vitro efficacy of cefepime against E. cloacae, with a much-improved MIC90 compared to either piperacillin-tazobactam or ceftolozane - tazobactam and an MIC90 comparable to that of ceftazidime-avibactam.
3. Literature suggest that cefepime-enmetazobactam may prove to be a valuable carbapenem-sparing option for empirical treatment of serious Gram-negative infections in settings with an elevated prevalence of ESBL-producing *Enterobacteriaceae.*

6. DOSAGE AND ADMINISTRATION (> 18 yrs of patients)

1. Administer 2.5 grams (2 grams cefepime and 0.5 grams enmetazobactam) every 8 hours by intravenous infusion over 2 hours for 7 days to 14 days, in patients 18 years of age and older with an estimated glomerular filtration rate (eGFR) between 60 to 129 mL/min.
2. Dosage adjustment is recommended in patients with renal impairment who have an eGFR < 60 mL/min or > 130 mL/min.

7. DOSAGE FORMS AND STRENGTHS

2.5 grams (cefepime and enmetazobactam) for injection, is supplied as a sterile powder for reconstitution in single-dose vials containing 2 grams cefepime and 0.5 grams enmetazobactam.

8. CONTRAINDICATIONS

In patients with a history of serious hypersensitivity reactions to the components (cefepime and enmetazobactam), or other beta-lactam antibacterial drugs.

9. WARNINGS AND PRECAUTIONS

1. **Hypersensitivity reactions:** serious and occasionally fatal hypersensitivity reactions, including anaphylaxis, have been reported with beta-lactam antibacterial drugs.
2. **Neurotoxicity:** Most cases occurred in patients with renal impairment who did not receive appropriate dosage adjustment of cefepime.
3. *Clostridioides difficile*-associated diarrhea (CDAD).

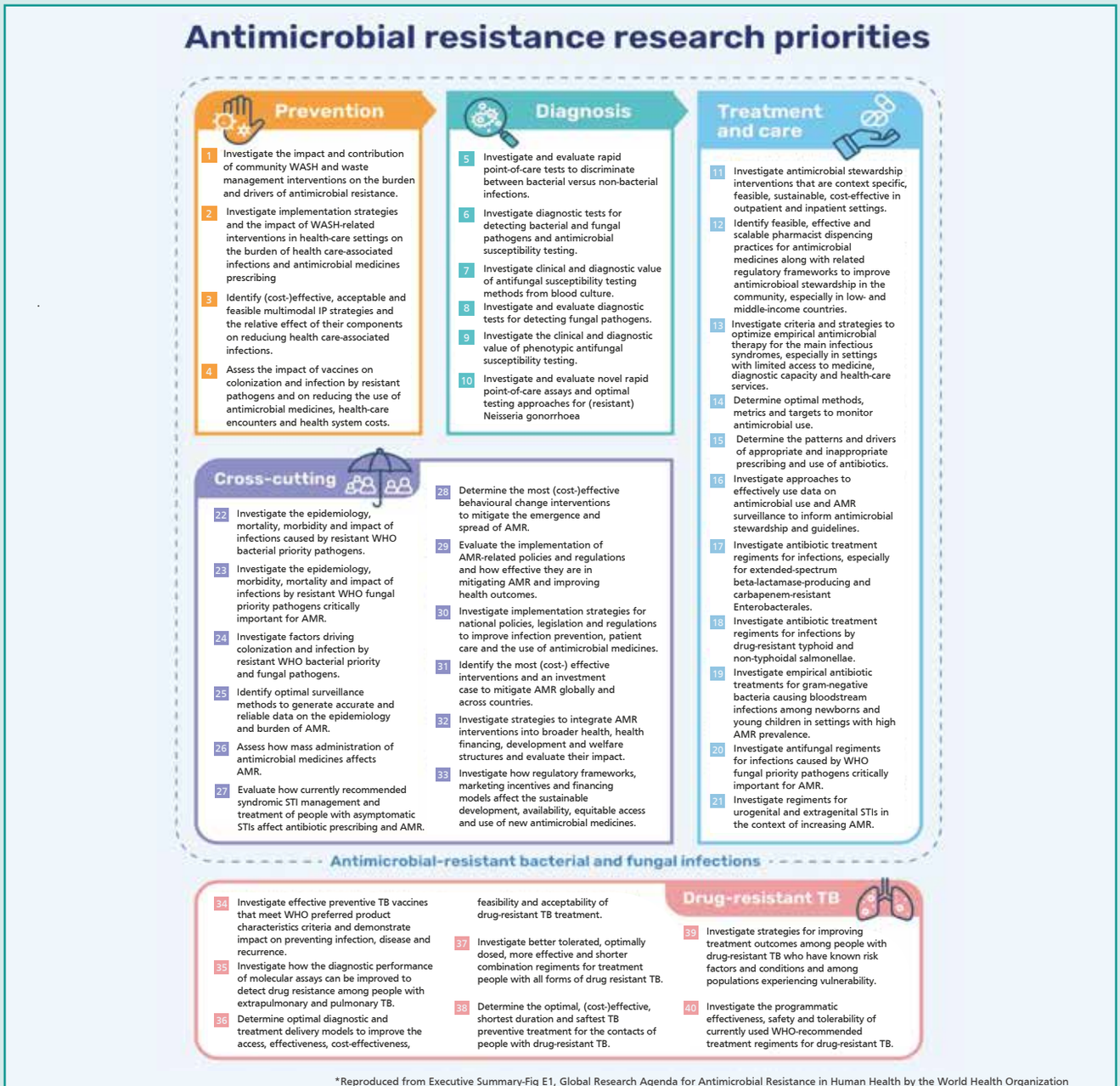
10. ADVERSE REACTIONS

The most frequently reported adverse reactions occurring in ≥5% of patients treated were

- Increased transaminases
- Increased bilirubin
- Headache
- Phlebitis/infusion site reactions

11. RECOMMENDATIONS FOR USE IN FORTIS

1. Criteria as per restricted category of antimicrobials.
2. Discs required to generate in house data against our own isolates.
3. Evidence based use to be encouraged.



*Reproduced from Executive Summary-Fig E1, Global Research Agenda for Antimicrobial Resistance in Human Health by the World Health Organization

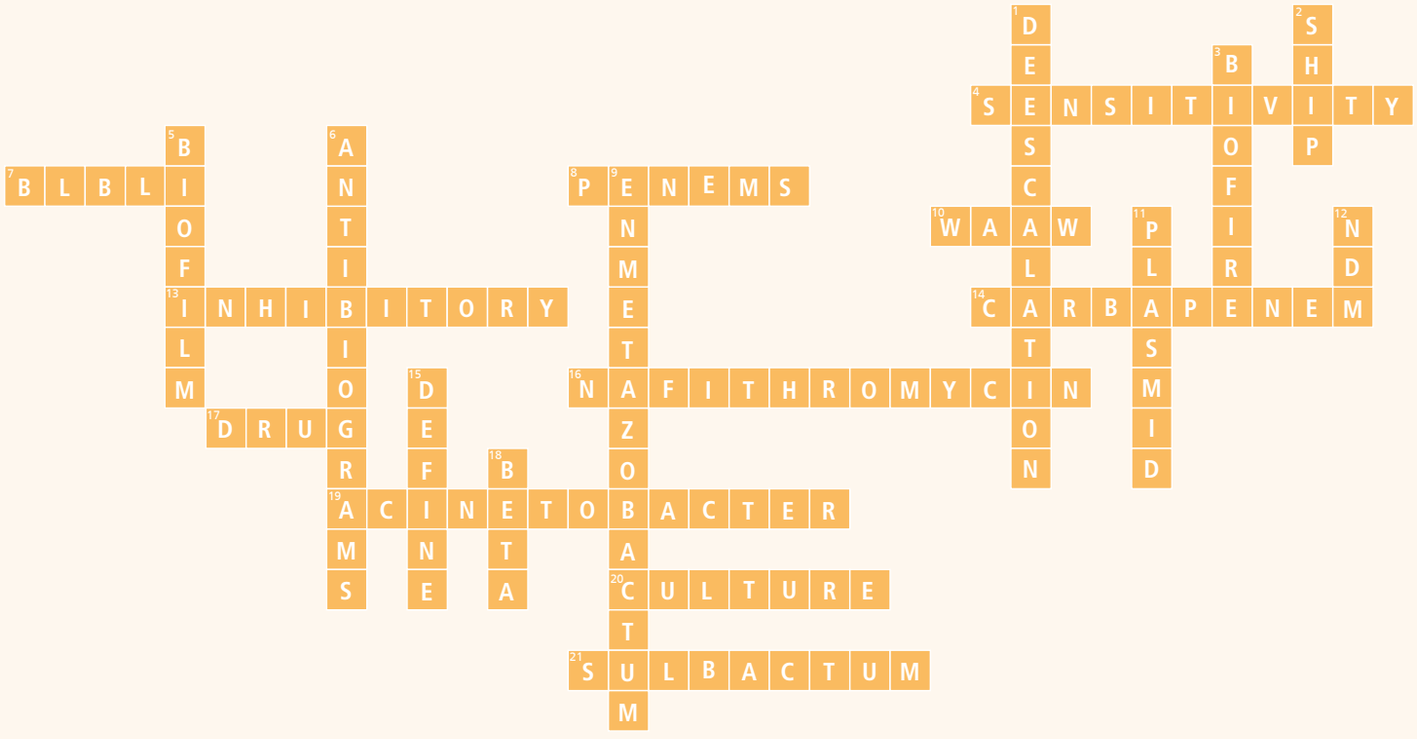
The Forty Research Priorities of the WHO Global Research Agenda for Antimicrobial Resistance in Human Health

CENTRAL ANTIMICROBIAL STEWARDSHIP COMMITTEE MEMBERS

S.NO.	Name	Designation
1.	Dr Bishnu Panigrahi (Chair)	Group Head - Medical Strategy & Operations Group
2.	Dr Murali Chakravarthy (Co-chair)	Senior Director - Anesthesia, CSICU and Pain Relief & Director - Clinical Affairs, Fortis Hospital, Bannerghatta Road
3.	Dr Anita Arora (Convener)	Director Medical Operations – Fortis Okhla, C-DOC, Group Head-Infection Prevention & Control
4.	Dr Mrinal Sircar	Director - Pulmonology and Critical care Fortis Hospital, Noida
5.	Dr Sandeep Gore	Director - Emergency Medicine Fortis Hospital, Mulund
6.	Dr Yashesh Paliwal	Director & Head of the Department – Critical Care Fortis Hospital, Anandapur
7.	Dr Anoop Purkayastha	Consultant - Head Emergency Fortis Escorts Heart Institute
8.	Dr Neha Rastogi	Consultant - Infectious Disease Fortis Memorial Research Institute
9.	Dr Anita Sharma	Director - Lab Medicine, Fortis Hospital, Mohali
10.	Dr Kirti Sabnis	Consultant - Infectious Disease Fortis Hospital, Mulund
11.	Dr Shivani Juneja	Consultant - Clinical Pharmacology Fortis Hospital, Mohali
12.	Dr Ravneet Kaur	Head Microbiology and Lab Services, Agilus Diagnostics, Fortis Hospital, Noida
13.	Girja Sharma	Chief of Nursing Fortis Hospital, Shalimar Bagh
14.	Latha Nonis	Chief of Nursing Fortis Hospital, BG Road
15.	Minimole Varghese	Chief of Nursing Fortis Hospital, Mulund
16.	Dr S. Narayani	Business Head, Fortis Hospitals, Maharashtra
17.	Bidesh Chandra Paul	Head Supply Chain Management, Fortis Healthcare
18.	Dr Narayan Pendse	Vice President – Medical Strategy and Operations
19.	Dr Akash Sud	Head - Clinical Governance, Quality Safety & Patient Safety & Medical Processes
20.	Dr Priya Goutham	Director Medical Operations (DMO), Fortis Hospitals, Bangalore
21.	Dr Mala Airun	Director Medical Operations (DMO), Fortis Hospital, Jaipur and Kolkata
22.	Dr Rajeev Nayyar	Director Medical Operations – Fortis Hospital Vasant Kunj, Shalimar Bagh, FMRI and Faridabad
23.	Dr Vikramjit Singh	Director Medical Operations – Fortis Hospitals, Punjab
24.	Dr Shanu Sharma	Director Medical Operations – Fortis Hospitals, Noida
25.	Dr Supriya Amey	Director Medical Operations – Fortis Hospitals, Mumbai
26.	Captain Sandhya Shankar Pandey	Chief of Nursing, Fortis Healthcare
27.	Gayatri Prashant Sapkale	Team Leader - Clinical Pharmacology, Medical Strategy and Operations

TRIVIA

Answer To The Crossword



DOWN

1. Deescalation
2. Ship
3. Biofire
5. Biofilm
6. Antibiograms
9. Enmetazobactum
11. Plasmid
12. NDM
15. Define
18. Beta

ACROSS

4. Sensitivity
7. Blbli
8. Penems
10. Waaw
13. Inhibitory
14. Carbapenem
16. Nafithromycin
17. Drug
19. Acinetobacter
20. Culture
21. Sulbactum

The Fortis Network

Amritsar


Anandapur, Kolkata


Bannerghatta Road, Bangalore

Chirag Enclave, New Delhi


Cunningham Road, Bangalore

Defence Colony, New Delhi


Faridabad


FEHI, New Delhi


FHKI, Kolkata


FLF Greater Kailash, New Delhi


FMRI, Gurugram


Greater Noida


Jaipur

Kalyan


Ludhiana

Ludhiana, Mall Road


Manesar

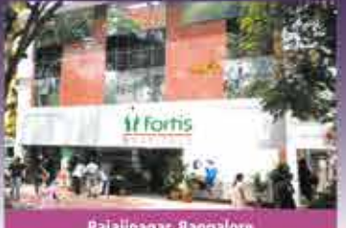

Mohali


Mulund, Mumbai


Nagarbhavi, Bangalore

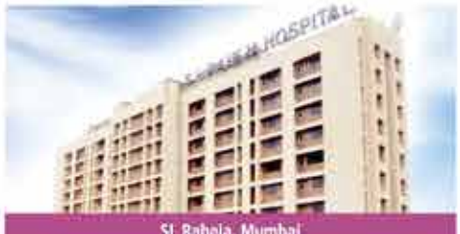

Noida


Raigarh, Chhattisgarh



Rajajinagar, Bangalore

Shalimar Bagh, New Delhi



SL Raheja, Mumbai


Vasant Kunj, New Delhi


Vashi, Mumbai

Please send your comments, feedback and suggestions to
clinical.connect@fortishealthcare.com